QUEENSLAND

DEPARTMENT OF AGRICULTURE AND STOCK

REPORT OF THE DIVISION OF PLANT INDUSTRY

1949-50

24 APR. 1951

DIVISION OF PLANT INDUSTRY

Report of the Director of the Division (Dr. W. A. T. Summerville).

The period under review has been characterised by increasing commitments undertaken by almost every branch of the Division of Plant Industry. The increase in commitments is due essentially to two factors. These are, firstly, the ever-increasing demand by farmers and graziers for services of the Department; and, secondly, the work arising out of advancement of primary industry with the development of irrigation projects and other land settlement proposals. Both of these are, of course, very desirable factors, but a third potent factor enters into most of the work of the Division. This is the biological factor, and biological material cannot be hurried in its development if the true answer to reactions to soil and climate is to be obtained.

Much of the work, then, entails obtaining knowledge which can be gained only after a considerable period. The period is longest when experience alone is the guide, shortest when experimentation can be used, and soundest when the two can be combined. It is in this last that the Division is most severely handicapped by the loss of staff which is apparently an inevitable part of war and its aftermath. The long-term ill effects of the losses sustained are now beginning to make themselves more apparent through the dearth of men of fifteen to twenty years' or more experience who could be expected to supply at least partial answers to the many questions arising from the developmental works envisaged. Now, more than for many years, investigation is thus called for, and this is reflected in the large percentage of the time of many officers which must be devoted to this type of work even though the call for advisory services is concurrently very heavy indeed. Officers of the Division have given a highly gratifying response to the demands thus made on their energy, both physical and mental.

In the investigational phase of activity the position may be summarised by reference to the fact that during the twelve months under review some 325 field experiments were continued or initiated, and 87 were finalised. The crops covered by these experiments number 38, including nine grain and oil yielding species, three fibre crops, six fodder crops, 14 fruits, and 10 species of vegetables. Additionally, some 280 pasture species are the subject of some form of experiment varying from investigations of farm management problems to observations on growth habits and requirements for propagation.

On the advisory side, field officers of the several branches have kept in constant touch with producers. Indicative of the desire to keep abreast of developments is the fact that at the request of farmers some 40 field days have been held and more than 80 lectures given. These forms of extension activity have the advantage that a large number of men can be contacted, as is shown by the fact that for soil conservation alone it is estimated that the aggregate attendance at such gatherings has exceeded 8,000. One disadvantage of field days lies in the very limited amount of individual contact, and personal visits by officers still appeal as the most effective method of farmer education.

STAFF.

During the past twelve months four officers have retired under age-limit regulations and the Director of Agriculture (Mr. C. J. McKean) has remained under secondment to the Queensland-British Food Corporation. During the same period five non-graduate technical officers have resigned, whilst four others are now absent in special circumstances, but in each of these four cases the absence is temporary only. More than offsetting the losses, the staff has been strengthened by the addition of sixteen graduates and nine other technical officers, together with ten additional cadets, of whom six are undergoing part-time training at the University. The resignations of nine members of the clerical staff and the transfer of two others is recorded with regret. Temporary embarrassment generally follows such moves, owing in part to the inevitable time lag before replacements can be secured and become familiar with new duties.

Both the Agriculture and Science Branches have made notable staff gains, and in the former branch agrostology has been strengthened to cope with the warranted increased attention to pasture improvement.

The most noteworthy step in relation to the staff of the Horticulture Branch pertains to pineapple work. After conference with the appropriate industry interests, a Consultative Committee was set up representative of the industry and this Department. The Committee freely discusses the problems with which the growers are faced and takes such steps as are necessary to have work initiated where deemed desirable. It is believed that the frequent contact for exchange of views must be of considerable value to all concerned, and the results to date certainly support that belief.

The Bureau of Sugar Experiment Stations lost the services of two field advisory officers, and effective replacement will be difficult to achieve for some time. An overseas scholarship tenable for three years has been awarded to enable the holder to prosecute studies in genetics with a view to carrying out fundamental work on sugar-cane breeding on his return to Queensland.

The staff of the Chemical Laboratory now totals twenty-nine, and though pressure on several sections is very great, the Laboratory is reasonably well placed for the most part.

SEASONAL CONDITIONS.

The seasonal conditions have been very variable. Following an abnormally cold winter, late spring rains gave promise of an exceptionally good summer. Excellent rains fell in October, and though grain harvesting was interfered with to a degree, the agricultural and main horticultural areas benefited very considerably. The greatest benefit, however, was felt in pastoral areas, and the State's pastures as a whole responded excellently. A hot dry period in midsummer offset the early rains to some extent, but late summer and autumn falls were again bounteous and the year closed with favourable conditions for the production of winter crops. The rains were not an unmixed blessing, however, for some producers, and delays in land preparation and harvesting owing to waterlogged conditions caused appreciable losses to vegetable growers in many areas, potato and tomato growers being the most severely affected. The seasonal conditions, even where not wholly favourable to the landholder, had some merit from the Departmental point of view in that they afforded opportunity to secure information not otherwise obtainable. Thus certain data in connection with Burdekin soils and pests and diseases of vegetables and other crops were obtained under conditions not frequently experienced.

SOIL CONSERVATION.

The fact that applications for assistance in combating erosion now exceed five hundred and embrace almost a quarter of a million acres is indicative of the awakening of the rural community to the menace of erosion. Satisfactory as this is, it does not give any grounds for complacency, and intensive work by this section of the Division will be required for many years to come. A disturbing feature of the present position is that to still too many people soil conservation conjures up pictures of massive soil-moving equipment and little else. Such an attitude is wholly deplorable. Whilst a limited amount of the necessary work in some cases is beyond the financial and physical resources of the individual, the farmer must appreciate that the scourge must be attacked at its source, and that source lies very largely in the incorrect practices which precondition the soil. The basis of economic and successful soil conservation is agronomic, not engineering. The tardiness with which this is accepted is understandable but nonetheless irksome and militates against rapid sound progress. Field officers of production branches have been given instruction in the subject so that they, whilst not specialising, can afford the farmer assistance against the menace, which in some of the most important agricultural areas of the State amounts to threat of catastrophe.

REGIONAL EXPERIMENT STATIONS.

As reported last year, virtually every field crop produced commercially, or considered likely to have commercial possibilities, is now being grown on one or more of the four regional experiment stations. These institutions have been developed considerably during the period under review and the broad purpose for which they were established is taking definite practical shape. This purpose, as has been stated in earlier years, is to determine the correct economic relationships of crops and animals, and as data are collected it becomes increasingly apparent that this is the road to permanence of agriculture in many parts.

The establishment of a dairy herd and what might be termed ancillary units of pigs and poultry at Kairi was accomplished during the year and the experiment programme is now being implemented. So far as Hermitage and Biloela are concerned the preliminary work has continued, but until the necessary buildings can be provided development of the main programme cannot proceed. It is hoped that at least one of these centres and perhaps both will be equipped during the coming year.

AGRICULTURE BRANCH.

The report of the Acting Director of Agriculture discloses the wide range of activities of officers of this branch. It will be seen that every avenue of approach to problems facing the producer of field crops has received attention, and progress can be claimed in each of the phases of plant breeding, agronomy, agrostology, and soil technology.

If the work of plant breeders is to be wholly successful, full use will have to be made by farmers of the certified seed produced within this State. The production of such seed is exacting, time consuming work, but provided the seed is used within the State is a very worthwhile job and should be expanded with the demand. The sound farmer knows that good seed is an essential basis for sure substantial returns.

In general agronomy the expanded acreages of wheat, linseed, and tobacco call for special mention. The results from the exploratory farm at Wrotham Park dealing with the production of supplementary fodders for beef cattle, together with the practical interest displayed by a number of pastoral companies, give substantial promise of important developments in districts hitherto regarded as mere natural pasturage areas subject to all the vagaries of the climate. Evidence is being accumulated that supplementary feeding, particularly by the use of grain sorghum, is practicable. The translation of that potential into actuality will not be easy but it is obvious that the attempt to do this is worth while.

The emphasis which has been placed on tobacco work is now showing results and the production of this crop is quickly assuming its rightful place in Queensland agriculture. That the Burdekin and Mareeba-Dimbulah areas will continue to develop and become really stable tobacco areas seems assured. The south-west (Texas-Yelarbon district) has, of course, been producing tobacco for many years, but the growers in this area should pay more attention to varieties than is the case at present.

Pasture is, and for a long time must remain, the State's most valuable and important crop. The attention given to this phase of Agriculture Branch activities therefore needs no further justification here.

HORTICULTURE BRANCH.

The pineapple retains its place as the leading fruit crop of the State and accordingly has been given a very great share of the time of the officers of the Horticulture Branch. By far the greatest emphasis at this stage is rightly

being placed on the dissemination and use of superior planting material. This is undoubtedly the only foundation on which the industry, relying as it does so largely on the export of processed products, can hope to keep its returns at a reasonable level. It is essential that that point of view be accepted by growers quickly, for the longer such acceptance is delayed the further and more difficult the retracing of steps.

Both papaw and avocado growing show signs of expansion, and provided factors which bear on marketing are given careful attention there are very great possibilities for quick and sound economic developments.

Tomato growers, perhaps to a greater degree than any other class of horticultural crop producers, recognise the essential need to commence with good seed, and therefore the keen demand for Departmentally certified seed by tomato producers is particularly gratifying. The whole problem of plant improvement, together with soil management investigations, constitutes the essential work of the three branch experiment stations situated at Redlands, Nambour and Kamerunga, respectively.

Whilst production of high quality produce is important, its value is greatly reduced where poor methods of handling for market or inferior marketing facilities prevail. The Preparation and Transport Section of the Horticulture Branch, therefore, is handling a comprehensive programme covering investigation of new methods, education of growers, and enforcement of legislation designed to improve the product ultimately available to the public.

BUREAU OF SUGAR EXPERIMENT STATIONS.

The forecast for the 1950 crop suggests that new peaks will be attained in the current season both in cane crushed and in sugar produced. The early estimate is for a crop of seven million tons calculated to yield 988,000 tons of 94 net titre sugar.

One of the outstanding features of the year is the continued and expanding success achieved by benzene hexachloride in grub control. In the 1949-50 period over 20,000 acres were treated for protection against this pest and a further 14,000 acres against wireworms. The year 1950 has been one of intensive grub damage on unprotected farms.

A pleasing degree of success was obtained with pre-emergence weed control in both light and heavy rainfall areas during last summer. Growers in the wet belt in particular are very enthusiastic regarding the control obtained and it is anticipated that commercial usage will rapidly develop.

During the year developmental work on the new sugar experiment station at Ayr proceeded favourably. The first plantings of sugar cane and seedlings will be made in the coming season.

CHEMICAL LABORATORY.

All branches of the Department offering technical service to rural industries at some stage in their work, with the exception only of the Bureau of Sugar Experiment Stations, enlist the help of the Chemical Laboratory. Thus the work of the laboratory to an extent reflects, and is reflected by, the work of the whole, but of course more particularly that of the Division of Plant Industry, with which it is most closely associated.

The necessity of chemical data being available is clearly brought out by the fodder work, since it is quite apparent that qualitative information or even figures on mere gross weight are an insufficient basis for recommendations. Here is a very good example of how precise scientific work can at least partially substitute for experience and thus shorten the time necessary for progress to be achieved.

The extent to which the Bureau of Investigation, the Forestry Sub-Department, the Land Administration Board, and the Irrigation and Water Supply Commission call on the help of this laboratory is at times embarrassing, but collaboration is certainly the only sound way in which the various plans of each in the sphere of land use can be furthered.

SCIENCE BRANCH.

The opening paragraph of the report of the Pathology Section dealing with the rust position in cereals gives a splendid example of the magnitude of the problems facing officers of the Division. There is little that is static in the work. On the contrary, as living material is being dealt with—and even the soil is a living system—the field is essentially dynamic and it is rarely that a problem, be it disease control or any other phase, can be said to be finally solved. In the particular instance to which attention has been drawn a new strain of fungus arising in 1949 could greatly alter the whole picture for a crop and crop prospects. Vigilance therefore becomes a keynote, and nowhere is this more essential than in the Science Branch with its problems of insect, disease and weed control.

The number of insecticides, fungicides and weedicides continues to increase, as also do the extravagant claims made by their manufacturers in some cases. There is no doubt that the entomologist and the plant pathologist are better equipped with such tools now than ever before, but there is still no panacea, and careful assessment of merits in each individual, or at least category of, pest must be undertaken.

Fruit fly constitutes a very serious menace to several of the more important fruit industries of the State, particularly since authorities in southern States have translated their apprehension into action, and accordingly particular stress is being laid on investigation of this pest.

The finding that impregnation of bags is probably as effective as dusting each potato in the containers is very important, and if confirmed on a commercial scale will be a most worthwhile contribution to both growers and consuming public.

Investigations on weed control and poison plants also constitute important phases of Science Branch activity, and worthwhile progress is recorded in each of these. The part played by the Botany Section in the investigation of Birdsville horse disease is particularly pleasing.

Report on Soil Conservation Services

Mr. J. E. Ladewig, Senior Soil Conservationist.

The period under review has been marked by a gradual expansion of activities in respect of an educational campaign, work on soil conservation demonstration areas, the provision of a technical advisory service, and the conduct of a soil conservation research programme.

The rapid increase in the volume of applications for technical advice and assistance in respect of soil conservation matters is indicative of a wider appreciation of the dangers of erosion; but it also indicates a general acceptance of the efficiency of soil conservation measures in countering this menace. The increase in applications for assistance is tabulated below:—

	No. of Applications.	Area. acres
Total to 30-6-48	95	28,000
Total to 30-6-49	250	86,000
Total to 30-6-50	502	241,000

To provide an adequate advisory service to the applicants now listed will require the full-time services of the present soil conservation staff for some years, even though field officers of the Agriculture and Horticulture Branches and the Bureau of Sugar Experiment Stations are assisting in the work, particularly from the agronomic aspects; numerical increase in staff is therefore urgent and is effected as personnel can be recruited and trained.

An increased interest in soil conservation matters has been shown by local authorities and farmers' organisations during the year, and as a result requests have been received for the planning and execution of group watershed control schemes in respect of 100,000 acres of land.

CONTOUR EROSION CONTROL.

Land reclamation work is the most urgent requirement in the many severely eroded areas of the State and in these parts is a necessary prerequisite to the application of correct land use practices. While every effort has been made to meet the urgent need for the reclamation and protection of the land, this has tended to obscure the vital necessity of modifying the farming methods which are the cause of present losses.

At least 4,000 acres of arable land have been saved by the application of soil conservation measures and a much larger area of lower country has been protected by the installation of these works; in the past year contour banks were constructed on an additonal 1,000 acres of land. Artificial waterways designed and constructed totalled 62, with an aggregate length of about 12 miles. Numerous diversions and pondage banks have been designed, surveyed and constructed to provide partial protection for lower arable lands.

These control works have been applied throughout the Darling Downs (see Plate 1, facing page 12), in the South Burnett and Monto districts, and on the Atherton Tableland (see Plate 2, facing page 12); special measures have also been designed and applied for the steep coastal horticultural lands, the canefields of the Childers and Mackay districts, and the tobacco lands at Ingham and Mareeba. These works performed satisfactorily throughout summer rains, which provided a severe test; on protected sites soil losses were insignificant, whereas adjoining untreated areas in most cases suffered serious erosion.

WATER DISPOSAL PROBLEMS.

One fundamental requirement for successful soil conservation work is that water disposal lines must be stable and able to transfer runoff to the permanent watercourses without further soil loss occurring. In many agricultural areas, chiefly the Darling Downs and South Burnett districts, the original drainage lines are now no longer suitable for water disposal because of excessive siltation or a severely eroded condition.

Numerous investigations concerning this problem have been conducted during the year in response to urgent requests from landowners and local authorities. The matter has recently been the subject of investigation and discussion by officers of the Irrigation and Water Supply Commission and this Department, and it is expected that a working plan will eventuate.

SOIL CONSERVATION DEMONSTRATION AREAS.

Twenty soil conservation demonstration areas have been established throughout the State for the purpose of illustrating in a practical way recommended methods of soil conservation. Some of these demonstrations were initiated in previous years, and in the past year these have been further developed simultaneously with the initiation of work on new ones. Delays due to wet weather considerably reduced the effective working time of Departmental earth-moving plant on the Darling Downs demonstration areas. Many of these areas were selected because of the severity of the erosion, and on some the arable lands were on the verge of abandonment as a result of advanced gully and sheet erosion. Consequently, major reclamation works were necessary and on one farm a total expenditure of approximately £7 per acre was required to stabilise the area. Of this amount £2 10s. per acre represented the direct cost of construction of contour banks, £4 per acre that of gully filling work, and 10s. per acre that of the construction of a dam. Since this position applies in respect of at least 100,000 acres of similarly eroded land on the eastern Downs, the cost of reclamation presents an economic problem.

Work on the soil conservation demonstrations on the Atherton Tableland and in the Monto district has proceeded satisfactorily during the year; farm equipment has been used almost exclusively on these areas and it has been shown that where eroded land can be treated in the early stages the cost is comparatively low and large earth-moving equipment not necessary.

PLATE 1.

Contour Furrows to Conserve Moisture on a Darling Downs Pasture.

PLATE 2.

Contour Banks on an Atherton Tableland Farm.

The activities on all demonstration areas have been followed with keen interest by farmers and the general public; two public field days were held on these areas (total attendance 900) and, as well as inspections of completed works, various soil conservation methods were demonstrated in the field.

Work executed on all demonstrations during the year included the construction of 480 acres of contour banks, 230 chains of pondage and diversion banks, 9,000 feet of artificial waterways, and four dams totalling 5,000 cubic yards; the planting of 1,300 trees; the establishment of 14 acres of improved pasture; and the sowing of 60 acres of green manure and cover crops.

SOIL CONSERVATION INVESTIGATIONS.

Two experiments previously established at Kairi Regional Experiment Station have been continued; both experiments were subjected to a series of intense rains during the summer months. The observations have confirmed the belief that where the open structured soils of the Atherton Tableland can be worked on the contour and correct land use practised, the major part of even moderately severe rains can be absorbed by the soil and so reduce the erosion incidence.

At Hermitage Regional Experiment Station, further steps were taken to initiate the major experiment designed to determine the effect on soil and water loss of various land use methods and crop rotations. Contour banks have been constructed on the experimental area and preliminary land levelling work has been executed. The design of suitable measuring equipment for runoff and soil loss determination is proceeding and will be finalised by the time the experimental area is ready for the establishment of this equipment.

The soil conservation investigations at Maroochy Horticultural Experiment Station have proceeded satisfactorily. Four exploratory treatments were designed and established on 25 per cent. slopes, and rains received in the spring and summer months were sufficiently severe to indicate the merits and defects of the various control systems being investigated.

EDUCATIONAL ACTIVITIES.

The activities in this field have been directed along two main lines; firstly, to place before farmers and the public generally the facts concerning the erosion problem, and, secondly, to provide for primary producers the technical information required to apply soil conservation measures.

The farm planning service mentioned in last year's report has been expanded considerably, and a total of 64 plans for 21,000 acres of land was completed during the year.

Eight public field days were held. the aggregate attendance at these functions being 1,630, or an average of over 200 at each. Field days provide an excellent opportunity for the dissemination of technical information because of the facilities available for practical demonstrations. At least fifty of the applications for advice on farm planning received during the year are known to have originated from field days.

An aggregate audience of some 8,000 people attended the 75 lectures given during the year to primary producers' organisations and other groups. Sixty-six film showings organised by the educational section of a large oil distributing company were supported by lectures by soil conservation officers.

Soil conservation displays have been featured at a number of Queensland shows, including the Royal National Exhibition at Brisbane, and provincial and country shows at Toowoomba, Jandowae, Miles, and Gladstone.

The major part of a soil conservation publication, *Soil Conservation in Queensland,* has been prepared, and four chapters have been published in the *Queensland Agricultural Journal.*

MACHINERY MODIFICATION.

The large amount of reclamation work involved and the alteration to farming procedures necessary for soil conservation have focussed attention on the need for modification and additions to farm tractors and equipment to meet the requirements of permanent agriculture.

Activities in this field have been fostered, and in many cases the preliminary investigational and design work has been carried out by soil conservation officers.

During the year a standard grader ditcher was redesigned and modified to enable the execution of the major types of soil conservation works on slopes of up to 40 per cent.; this work has been completed and tests satisfactorily performed.

The "contour liner," an instrument attached to a tractor and intended to indicate when the tractor is following the contour, was tested during the year, and results indicate that this instrument may be satisfactory for pasture furrowing on gentle slopes and so eliminate the necessity for expensive surveying work.

The design and modification of existing machinery to enable its utilisation for stubble mulching procedures has received attention in the Darling Downs, South Burnett and Atherton districts. The preliminary design has been completed in all districts, and testing will be completed at the end of next summer.

The attachment of simple dozer units to farm tractors has been fostered throughout the State to reduce the cost and facilitate the execution of reclamation works. It is estimated that twenty of these dozers, many home-made, have been fitted to farm tractors in the South Burnett district this year, two at Atherton, and three on the Darling Downs. It is considered that the more general utilisation of this type of equipment on the Darling Downs will assist considerably in the drive to combat the very severe erosion in that area.

Report on Regional Experiment Stations.

Mr. W. G. Wells, Director of Regional Experiment Stations.

The more important findings are either presented in the following summaries or included in the reports of the branches conducting the investigations. The monthly precipitations are presented in Table 1 to indicate the rainfall under which the investigations were conducted.

TABLE 1.

Rainfall, 1949–50 Season (in inches.)

Month.	Hermitage.	Biloela.	Ayr.	Kairi.
July	1·56	·64	Nil	1·44
August	·62	·08	Nil	2·23
September ..	2·10	·96	Nil	·98
October	6·68	5·94	2·20	·71
November ..	2·18	3·79	1·30	6·16
December.. ..	1·31	1·03	Nil	5·11
January	1·79	3·47	9·98	19·64
February	5·70	8·14	6·55	5·60
March	1·13	2·66	20·89	16·27
April	·86	2·52	4·82	11·57
May	·80	2·26	1·16	·43
June	8·90	2·12	·63	5·30
Total.. ..	33·63	33·61	47·53	75·44

HERMITAGE.

The weather experienced at this centre was very suitable for the winter-grown crops but did not favour high yielding of summer-grown crops.

Oats.

The encouraging seed yields obtained in 1948 with Victoria x Richland, Fulghum x Victoria and Klein—varieties of oats that have shown considerable resistance to crown rust in districts where the standard commercial varieties cannot be grown satisfactorily—led to further investigation on a larger field scale in 1949. The results confirmed the previous season's finding that all three varieties produce satisfactory yields of planting seed of good quality under eastern Darling Downs conditions.

Wheat.

The standard wheat varietal testing was continued in 1949 on fertile alluvial black soil. The yields obtained are presented in part in Table 2 in comparison with the yields of the same varieties on similar soil in 1948 and in the standard varietal trial at Biloela Regional Experiment Station.

TABLE 2.

Wheat Varietal Trial Data.

Variety.	Hermitage. Yield (bushels per acre).		Biloela. Yield (bushels per acre.)	
	1948.	1949.	1948.	1949.
Gabo	39	50·3	37·4	39·7
Puno	35·6	38·6	42·1	37·5
Fedweb 5 ..	34·9	42·7	37·4	39·9
Flora	34·7	30·1	35·2	..
Pusa 4	34·1	37·8	38·8	34·3
Puora	33·3	38·3	38·1	33
Seafoam	32·2	35·0	34·2	33·4
Kendee	31·8	44·3	..	36·4
Charter	31·6	43·1	39·7	31·9
Yalta	24·1	38·3	..	..
Mean Yield ..	33·1	39·8	37·8	35·7

The relative order of merit of the varieties, with the exception of Gabo, shows a marked variation in the two seasons at both centres. The consistently high yielding performance of Gabo may indicate that with ample subsoil moisture this variety can be expected to yield at least moderately well in both districts even under very dry conditions during much of the growing period.

Sunflower.

The testing of the main varieties of sunflowers of which stocks of seed are available in this State was continued. The yields obtained at Hermitage, Biloela and Ayr are included in Table 3 for ease of comparison. At Ayr the crop was grown in winter and spring and was irrigated.

TABLE 3.

Variety.	Yields (lb. seed per acre).		
	Hermitage.	Biloela.	Ayr.
Advance (ex Laidley) ..	968	1,062	..
Giant Russian	808	1,104	2,430
Advance (ex Canada) ..	714	1,068	..
Mennonite	562	822	1,675
Sunrise	486	829	1,641

The value of supplementary moisture during the growing period is clearly shown by the yields of the varieties common to all three stations. Hermitage experienced a dry maturation period; at Biloela the early half of the growing period was dry, but good rainfall occurred during the maturation of the crop; and at Ayr ample irrigation applications were made throughout the growth of the crop.

Miscellaneous Crops.

A trial of the Queensland double hybrid maize which led in last season's trial at this centre, the New South Wales double hybrid D.S. 28, and a local strain of Star Leaming gave promise of yielding interesting results in favour of the double hybrids, but lack of rain to complete the maturation of the crop caused practically a complete failure of the experiment. A canning bean varietal trial was again conducted for the Agriculture Branch, and a trial planting of Brown Beauty French beans for seed production for the Horticulture Branch yielded promising results.

Pastures.

The testing of some 117 introduced grasses and legumes was continued in the nursery area. The brome grasses again showed promise. Rhodes grass (local strain) and Kafue, a late seeding strain of this species, continued to perform as well as if not better than any other summer-growing grasses under trial. Auburn woolly pod vetch again showed that it is well adapted to the district, and seed multiplication will be undertaken.

In further trials of lucerne in cultivated rows, Hunter River, Hairy and Smooth Peruvian, and Buffalo varieties and a strain originating in Bolivia indicated that they can produce satisfactorily under this cultural system even under very dry conditions.

Soil Fertility.

The green manure-superphosphate experiment of the previous season was repeated on the same area—the third year in succession—to test for residual influence of the treatments. An average yield of 39·5 bushels of wheat per acre was realised over the experiment and again no significant differences were obtained through the use of any of the green manures—maize, Sudan grass, Poona pea and combinations of the last with each of the other crops. An overall response of wheat was obtained to 200 lb. superphosphate per acre applied prior to planting the green manure crops. The greatest gain per treatment was 4.25 bushels of grain.

The complex fertilizer trial mentioned in the last report was repeated on two soil types on the lower slopes. On a soil comparable to the site of the green manure-superphosphate trial, no significant differences were obtained, although there was a suggestion that 224 lb. superphosphate improved yields over the "no phosphate" plots. On a lighter soil, where green manure crops had been turned under and an average yield of 48·5 bushels was realized with the good season, no significant differences or even trends were obtained.

On a much less fertile soil on the slopes a significant response of four bushels of wheat per acre was obtained from an application of 112 lb. of sulphate of ammonia at planting time, but an application of 224 lb. superphosphate alone at this date did not increase yields. Ploughing under cowpeas in time for them to decompose well before the wheat was planted failed again to improve yields. In another experiment on similar soil, but without a green manure ploughed under, a highly significant response was obtained to an application of 112 lb. sulphate of ammonia and 224 lb. superphosphate, the gain amounting to seven bushels per acre, or 22.4 per cent. Superphosphate alone did not improve yields.

Soil Conservation.

Owing to the hillside native pastures having been badly overgrazed prior to the re-occupation of the property by the Department, stock were withheld to study the rate of natural regeneration as a part of the soil conservation investigations. Such an excellent cover resulted from these measures that insufficient runoff was obtained in 1948-49 to provide ample water in a dam constructed for the soil conservation investigations. Similar difficulties were encountered in the past year until a heavy rain was experienced when the surface soils were sodden. The season's experience showed that severe runoff may occur on clay slopes, even when they are well grassed, if the surface soil is saturated when heavy rain falls.

BILOELA.

The weather experienced at this centre illustrated the benefits to be obtained from practising rotations which provide good supplies of subsoil moisture at the planting period of either winter or summer grown crops.

Oats.

The programme of testing oat varieties for grazing was enlarged early in 1949 to embrace Belah, Fulghum, Mulga, Victoria x Richland, Fulghum x Victoria, and Klein. Planted in March on soil wet to a depth of 44 inches, all varieties grew slowly during the wet conditions which prevailed until after the early June rains. With the onset of the following dry weather, the most rapid growing types—Mulga and Victoria x Richland—quickly outyielded the rest until finally checked by the lack of supporting rains. These two varieties produced the most grazing and hay for the season, while Klein and Fulghum x Victoria produced the least. Periodic sampling through the season brought out some striking differences in the protein, calcium and phosphorus contents, both between varieties and at different periods of growth of a variety.

Wheat.

A varietal trial of seven of the leading standard wheats reported upon in the previous season, three Queensland hybrids, and the New South Wales Kendee, was conducted. Planted on 6th June in soil wet to a depth approximating 42-48 inches, all varieties grew well until the time of heading, although only ·64 inch of rain had been recorded since planting. A further ·52 inch on 10th September was sufficient to ensure a crop. Heavy rains commencing early in October caused some germination of the grain in the earlier maturing varieties. The mean yields of the seven varieties common to both seasons are given in Table 2. The colder winter of 1949 may possibly explain the improvement in performance of Gabo in comparison with Puno, Gabo being a New South Wales wheat bred in a colder climate than is normally experienced at Biloela. The value of having good depth of subsoil moisture at planting was again clearly demonstrated.

Linseed.

Yields in a varietal trial of the seven most promising varieties of linseed grown in this State, planted on 4th May, 1949, as a whole were 100 lb. of seed per acre better than the mean yields obtained in the 1948 varietal trial at this centre. This may reflect the merits of planting earlier than 29th June, the planting date of the 1948 experiment. Morocco, with a yield of 741 lb. of seed per acre, was again the leading variety. The mean yield of 626 lb. seed per acre produced by Morocco over the two seasons, when compared with the mean yields of Gabo and Puno wheats, respectively 2,310 lb. and 2,382 lb. per acre from similar soils, indicates the greater water requirements of linseed under Callide Valley conditions.

Grain Sorghum.

In a varietal trial of ten leading grain sorghums planted on 5th December in rows spaced 3½ feet apart, Plainsman and Caprock—two medium-early varieties introduced in recent years from the United States of America—performed well throughout the season, even under the very dry conditions of most of January, and produced 37 bushels per acre, outyielding the rest of the varieties in the trial. The depth of wet subsoil at planting time was 30 inches, which provided insufficient moisture to carry

the earliest maturing varieties past the flowering stage without suffering some stress conditions during the hot dry weather at the end of January. On the other hand, the slower maturing types suffered serious loss of late flowers through a heavy midge attack early in March. Weekly determinations of the prussic acid content of all varieties were made throughout the growing period until all were ready for harvesting. The results indicated that under the season's conditions the prussic acid content of the slower maturing varieties was either well above or approximated what is accepted as a dangerous level—i.e., 20 milligrams per 100 grams green material—throughout most of their growth until the grain had hardened, whereas the content of Martin—the quickest maturing variety—did not reach a dangerous level. The content of other quicker maturing varieties was also satisfactory after the first 45 days of growth, i.e., after the plants had reached about 30 inches in height.

Analyses of the feeding value of the leaves and stalks of several varieties of grain sorghum were made, commencing soon after harvesting of the grain in the 1947-48 varietal trial. The results indicated that for some months the standing stover would provide feed of high protein and phosphate content, although the protein content declined with length of exposure to the weather. Further investigations are in progress.

Cotton.

The results of the 1948-49 experiments, which were not completed in time to be included in the last report, may be summarised as follows:—

1. Planting rains did not occur until November and as a result yields of all dryland cotton, in keeping with the findings of previous seasons, were below those usually obtained from the more normal October plantings.

2. Cultural operations which had resulted in the conservation of a good depth of subsoil moisture by planting time contributed to the satisfactory yield, for such an irregular season, of 954 lb. of seed cotton per acre.

3. Applications of 9 to 12 inches of supplementary irrigation were beneficial, the average yields of irrigated plots ranging from 1,312 lb. to 1,752 lb. seed cotton per acre.

4. In a time-of-watering experiment, the three treatments receiving a 3-inch application six to eight weeks after planting plus three other waterings averaged 1,941 lb. seed cotton per acre, with the leading treatment yielding 2,063 lb., compared with an average of 1,564 lb. for the three treatments which did not receive this additional watering.

5. The results obtained in irrigated trials of hybrid strains bred at Biloela indicated that several of them may prove superior to the commercial varieties in lint percentage and yield per acre of both seed and lint cotton.

6. Thirty-two acres of cotton were mechanically harvested with satisfactory results, the machine averaging .85 acre per hour in bulk areas. Machine-picked cotton contained less stained fibre than companionate hand-picked cotton, and was graded Middling in comparison with Middling Light Spot for the latter. The machine-harvested cotton also averaged slightly higher lint percentage through elimination of cotton from diseased or partly immature bolls. The efficiency of the machine varied with the type of plant harvested, 97 per cent. of the bolls being picked in the varieties with the most open habit of growth and down to 78 per cent. in very leafy varieties.

Pasture Investigations.

The yields obtained in comparison with Rhodes grass of different ages of establishment demonstrated once again the need for growing this grass in short-term leys on forest soil.

The testing of row-cultivated areas of *Paspalum scrobiculatum* (scrobic), blue panic, green panic and Rhodes grass was continued. The results obtained in tests of selective grazing by dairy cows indicated that preferences were largely correlated with the stage of growth of the grasses, no one species always being preferred. All four species were established in separate areas during the wet season to provide facilities for testing the relative merits of row cultivation and broadcast stands of each one next summer.

The nursery of grasses and legumes was further increased during the season, and some 106 species and strains are now being investigated. Several species have shown sufficient promise to justify multiplication to permit establishment in trial grazing areas.

The testing of Poona pea and C.P.I. 9432, a strain of Poona pea mentioned in the last report, was repeated. The results confirmed the previous findings that the newer introduction produces much more heavily than the standard variety and matures seed later, thus providing considerably better autumn grazing than the standard from March onwards, especially when following a good wet season.

AYR.

There was further development of this regional experiment station during the year. An adjacent area of 29 acres of light soils was leased to permit the initiation of a comprehensive programme of pineapple experimental work and cost-of-production studies. Two acres were set out with planting material secured from Maroochy Horticultural Experiment Station, and three acres were planted with a good commercial strain obtained from the Nambour district. Some 25 acres of irrigated pastures were established for the purpose of conducting grazing trials.

A comprehensive programme of crop experiments was completed. The findings in experiments relating to potato culture will be reported by the branch responsible for conducting them. The results obtained in the more important experiments conducted by the station staff are described in the following summaries:—

Sunflower.

A varietal trial planted in April, 1949, with an application of a 10.10.0 fertilizer at the rate of 160 lb. per acre and given a side dressing of 56 lb. sulphate of ammonia when the plants averaged 12 inches in height, made very satisfactory growth with the aid of four irrigations. The experiment was harvested early in August, the yields obtained being as given in Table 3. The results indicate that this important vegetable oil crop has definite possibilities as an irrigated crop in the district.

Linseed.

A varietal trial embracing the same varieties tested at Biloela was planted in May, 1949. Although an application of 160 lb. per acre of 10.10.0 fertilizer was given at planting time, and a side dressing of 112 lb. per acre of sulphate of ammonia when the plants were nine inches tall, plant growth in the later part of the crop season indicated clearly the need for additional nitrogen. Yields were low, the leading variety, Bolley Golden, producing at the rate of 654 lb. seed per acre, with Morocco, the leading variety at Biloela, yielding 554 lb.

More satisfactory yields were obtained in seed multiplication areas of Punjab 47 CI. 1115 (see Plate 3, facing page 20, and Imperial CI. 1114, two new strains obtained through the U.S. Department of Agriculture from the Imperial Valley irrigation district in California. Planted on more fertile soil than the varietal trial and given only a pre-planting application of 160 lb. per acre of the same fertilizer, vigorous growth was obtained which yielded respectively 1.432 and 1,334 lb. seed per acre. These strains will be further multiplied in the coming season and also will be included in a repetition of the varietal trial.

Maize.

A maize varietal trial of three Queensland bred double hybrids, Star Leaming and Improved Yellow Dent was grown during the winter season to test the possibility of obtaining good yields of maize to supplement grazing pastures during the normal dry spring. The trial was planted on 28th April, 1949. Yields were not impressive. It is probable that the very cold temperatures experienced during July adversely affected yields. Accordingly, the experiment is being repeated in the coming season, planting in early August.

Sorghums.

Several strains of Coastland—an open headed type of grain sorghum bred by the Department's Senior Plant Breeder while stationed at Biloela—were grown as a winter crop in comparison with several standard varieties, and until destroyed by birds gave promise of producing heavily. The general growth and attractive open head of Coastland suggested definite possibilities for this variety as a winter crop on the Burdekin if grown in sufficient acreage to minimise the effect of bird damage.

The loss of seed through attacks by birds, and the high nutritive value of grain sorghum stover at Biloela, focussed attention on the possibility that summer grown sweet sorghums might contribute more total nutrients than grain sorghums for maintaining cattle in satisfactory condition during the usual dry spring in the Burdekin district. Accordingly, a varietal trial of eight of the most promising sweet varieties was planted in late January. The trial is not completed, as it is proposed to allow the crop to stand in the field until late spring to provide material for analysis of the nutrient content. By mid-June, however, a heavy tonnage of attractive material was available in all varieties.

KAIRI.

Facilities for implementing the programme of investigations planned for this centre were increased by the establishment of a Jersey dairy herd. The Division of Animal Industry was thus able to carry out investigations relating to the use of dairy cows and calves, pigs and poultry to consume the various crops produced on the station.

The weather experienced at Kairi was favourable throughout most of the year. As a consequence, good yields of pastures and crops were produced and all areas were in a satisfactory condition for the Field Day held on 14th April, which some 130 visitors attended.

Oats.

Excellent results were again obtained with Victoria x Richland, Fulghum x Victoria and Klein, and it apears that by planting areas of each of them, provision can be made either for grazing from June to November inclusive or for the production of heavy tonnages of good hay. Queensland hybrids supplied by the Agriculture Branch are under trial this winter to ascertain whether they contain even better grazing types.

Wheat.

The promising results obtained with June plantings of the Warput variety in 1948 and 1949 have led to more extensive trials of wheats during the current winter in an endeavour to obtain a thoroughly rust resistant type which would allow of earlier planting and thus receive the full benefit of the autumn rains.

Maize.

The main features connected with the season's investigations in this crop have been the reduction in weed growth in areas on which oats followed maize for silage, the general high yields obtained with the station's strain of Durum maize, and the low incidence of disease-affected ears in crops produced in the main rotations in which maize for grain is grown for two years following five years of either lucerne or lucerne plus Rhodes grass pasture.

Pasture Investigations.

An even colder winter in 1949 than in 1948 severely killed back once more the tropical legumes *Centrosema pubescens, Clitoria ternatea* and *Glycine javanica.* Lucerne, on the other hand, grew well during the winter both in the main pure bulk plantings and in combination with Rhodes grass. Cultivated row lucerne on a shallow soil again performed better than companionate lucerne in drills spaced seven inches apart. Row spaced scrobic germinated so thickly between the rows at the start of the wet season that the area was left uncultivated. Calf grazing trials on the resultant growth gave most promising results and it would appear that after the establishment period scrobic need not be cultivated in this district. Row cultivation of green and blue panic grasses may also be placed in the same category if a suitable legume cannot be discovered for interrow planting with these species.

Soil Conservation.

Further facilities for conducting soil conservation investigations were completed during the season, together with diversion banks to control runoff waters in critical positions revealed by the previous season's heavy rains. It is now felt that soil erosion is well under control at this centre.

Report of the Agriculture Branch.

Mr. D. O. Atherton, Acting Director of Agriculture.

A great deal of attention was devoted to advisory services to farmers, both from the Brisbane office and from country centres. Many field experiments were conducted to clarify problems associated with crop production and to investigate the growth of plants not already established in commercial production in Queensland.

An exploratory farm was established in one of the hitherto uncultivated black soil areas in the far northern inland portion of the State. Experimental work was continued on three tobacco experiment farms in the north of the State.

CROP PRODUCTION.

Wheat.

The weather conditions in 1949 were reasonably favourable for this crop, except for the exceptionally cold and dry winter, and a total planting of 670,000 acres was effected. The dry winter and unusually wet late spring were not altogether suitable for the crop and the adverse effects of lodging and bleaching of grain caused by spring storms is apparent in the lower yield of approximately 11,800,000 bushels.

Maize.

The early spring rains encouraged many growers to plant in October and November, but the hot, dry weather of midsummer was unfavourable for the complete development of these early sowings and many of them were used as stock fodder instead of being left for grain. However, suitable rains in late January and February made further sowings possible and these late planted crops are now yielding well. As a result it is expected that some 3,500,000 bushels will be harvested from the estimated area of 130,000 acres. Increased attention is being paid by commercial growers to hybrid maize, particularly to strains developed in the State.

Grain Sorghum.

The Queensland-British Food Corporation extended planting activities in the Clermont-Emerald-Springsure district. In the remainder of the State, chiefly in the Darling Downs and Burnett districts, approximately 75,000 acres were planted for an estimated yield of 2,250,000 bushels. The State's grain sorghum was affected to some extent by the dry spell in summer but not to the same extent as maize.

Sunflower Seed.

The area devoted to this crop was about 10,000 acres, with about half being sown by the Queensland-British Food Corporation in Central Queensland. Yields are not expected to be high, but the total crop may be 60,000 bushels.

Linseed.

The area sown to this crop, mainly on the Darling Downs and in the South Burnett, was approximately 11,000 acres, or nearly twice that of the previous season. Heavy frosts affected some sowings adversely, particularly on the Downs, and the appearance of pasmo disease also reduced the harvest. The yield from 11,000 acres was only about 60,000 bushels, although corn ear worm was effectively controlled in many areas by insecticides.

Canning Beans.

This crop remains firmly established as one of the minor cash crops of southern Queensland, particularly on parts of the Darling Downs and in the South Burnett. Conditions were much less favourable than those of last year and only 15,000 bushels are expected from the 1,500 acres harvested of the 5,000 acres planted.

Soybeans.

No large commercial plantings of this crop have yet been made, but the testing of promising varieties has been continued. Recently commercial firms have shown some interest in purchasing soybeans at remunerative prices and farmers may plant greater areas next summer.

Peanuts.

Seasonal conditions were reasonably favourable for the 26,000 acres planted, although the dry period in midsummer and the wet autumn had an adverse effect in some cases. The total crop is not expected to exceed 10,000 tons.

Pumpkins.

The weather conditions reduced expected yields to a considerable extent. Crops planted for late harvesting gave very poor yields owing to the effects of the wet weather in autumn, and the incidence of fungus diseases was higher than usual. Many areas were not harvested and the sales of about 19,000 tons were considerably lower than normal.

Potatoes.

Seasonal conditions were generally unfavourable for both spring and autumn plantings of this crop. Although some farmers had satisfactory results, in many cases yields were seriously affected by rotting of seed in the ground and also by abnormally high flooding. The yield is not expected to exceed 25,000 tons from about 10,000 acres.

Onions.

The crop harvested in 1949 gave reasonably good returns, although the heavy late spring rains affected quality to some extent. Crops in the Lockyer did not show the same tendency to throw a flower stalk as was experienced in the previous year. The total yield was approximately 13,500 tons from the 3,500 acres sown, mainly in the Lockyer Valley.

Tobacco.

Most of the area now devoted to this crop is irrigated and returns were quite satisfactory. Where the crop was grown without the aid of irrigation in the Dimbulah district, the rainfall in spring and summer was adequate and good crops were obtained. Further expansion of the

industry occurred in the Herbert and Lower Burdekin areas. Interest in this crop has also revived in the Bundaberg-Miriam Vale district.

Owing to the unusually wet conditions in spring, some blue mould occurred in the field, particularly in northern Queensland, but the leaves lost did not affect yields to any marked extent. About 2,450 acres were planted, and the total yield is expected to exceed 2,500,000 lb. If this expectation is realised it will be the first season in which the State average has been higher than 1,000 lb. of cured leaf per acre.

Cotton.

It is apparent that farmers are still reluctant to re-enter the cotton growing industry, although the mechanical harvesters now available are capable of harvesting approximately 1,500 acres. Efforts to establish the crop in the Burdekin Delta have been unsuccessful. The season's cotton is still being harvested but it is not expected that the yield will exceed some 700 bales of lint from less than 4,000 acres planted.

Lucerne.

Seasonal conditions were quite favourable for the development of this crop early in the spring, and good quantities of prime quality hay were produced before midsummer. The period of protracted rains and, in some areas, floods, in late summer and autumn adversely affected many fields and reduced the yields of hay very considerably. Owing to the effects of floods, replanting became necessary on many farms.

Pastures.

The season over most of the State, with some exceptions, as in the Goondiwindi-Inglewood district, favoured prolific pasture growth, and yields in terms of weights of green matter reached record proportions. Following the previous good year the heavy rains in the far south-west, and particularly in the sheep country, have been an embarrassment because they have caused rank grass and herbage growth.

In much of the sub-coastal and coastal cattle and dairying lands, prolonged rains have induced coarse unpalatable growth, which will also constitute a serious fire hazard.

AGROSTOLOGY.

The main pasture activities were confined to the dairying industry and, as in previous years, the work was largely financed by the Australian Dairy Produce Board. Investigations are also in progress at the Bureau of Tropical Agriculture and the Wrotham Park Exploratory Farm. Close contact in an advisory and consultative capacity was maintained with the pasture work being conducted on regional experiment stations and Gatton Irrigation Research Station.

Experiments on dairy farms number 64, and two small trials were located on cattle raising properties. Many of the trials are complex in nature, combining fertilizer and cultural treatments with numerous sown pasture species and also taking cognisance of soil conservation requirements

District Pasture Surveys.

The Daintree River dairying lands were examined and a farm-to-farm survey completed, special attention being paid to encroachment by blady grass. A report was prepared on lantana infestation of dairy farms in the Mackay district. An examination of the south-eastern coastal dairying lands revealed a strikingly prolific growth of *Lespedeza striata.*

Pasture Introduction.

Seed was harvested from the more promising introduced species being grown at the regional experiment stations and in the plant introduction gardens at Mackay and Rockhampton.

Exploratory Plots.

Nineteen small plots, comprising summer and winter grass and legume species, are being maintained in twelve agricultural districts from the far north to the southern border.

Grazing and Persistence Studies.

The major grazing trial is located at the Bureau of Tropical Agriculture and is discussed under that heading in this report.

On the Atherton Tableland pasture plots established on old maize land, stock preferred scrobic, green panic and molasses grass to Rhodes grass, and green panic and molasses grass successfully competed with weed growth.

At Peachester, buffel grass, green panic, paspalum and Rhodes grass were allowed to seed before grazing. A continuing preference for buffel was so marked that this species was nearly eaten out while Rhodes grass was almost untouched. Similar palatability observations were made at Upper Caboolture and Dayboro. The taller growing grasses, such as green panic and Rhodes grass, appear to have an inhibiting effect on the spread of mat grass. At Dayboro, Kenya Rhodes grass proved more palatable than the common Rhodes strain and it also showed promise in the Mackay district.

Fertilizer Trials.

Marked responses to lime and superphosphate at Conondale and to lime, superphosphate and potash at Peachester were maintained. The treated areas are under observation for residual effect. Areas at Peachester topdressed in the autumn of 1948 were still grazed in preference to untreated areas. At Maleny the heavy application of lime and of dolomite increased the growth of white clover, but the cost of treatment would probably render the practice uneconomic. The response to superphosphate of pilot plots on parts of the Eungella highlands and in the Kingaroy district was marked.

Renovation Trials.

Renovation trials in areas infested by blady grass and mat (or carpet) grass indicated that, where practicable, ploughing, short term cropping, and resowing to grass and legume is the best means of restoring productivity. At Cooroy, disc renovation together with top-dressing increased pasture productivity and decreased the mat grass population, but the change was slow. At Worongary, in the poorly drained mat grass infested pastures, shading either by trees or by cut grass depressed the growth of mat grass. Analyses showed that

soil in the shelter of the swamp oaks was higher in phosphate and potash than soil from open land. Heavy discing in this area resulted in thick clover growth and increased palatability.

Contour Furrows.

In the Gympie and Beaudesert districts, contour furrows increased the growth of pastures. Kikuyu grass was established in the furrows, by using cowyard manure carrying seed of the grass ingested during grazing.

Pasture Irrigation.

On land being prepared at Homebush for the flood irrigation of pastures, one annual crop was grazed and a second one planted. The permanent pastures will be established next year.

Pasture Weed Control.

An experiment on the control of bracken fern at Ravensbourne was completed. The hormone weedicides used were ineffective, but sodium chlorate reduced the stand by 50-70 per cent., as did also regular mowing. The effect of management on a molasses grass pasture being invaded by blady grass was studied at the Bureau of Tropical Agriculture.

FIELD CROP INVESTIGATIONS.

Wheat.

A full-scale wheat breeding programme was continued at Hermitage Regional Experiment Station, with the aid of subsidiary rust nursery plots at Dalby, Lawes and Moggill. Natural rust infestation was heavy at Hermitage, enabling selection to operate efficiently upon hybrid progenies. New fixed crossbred strains were introduced into the preliminary replicated yield test, and ten of these exceeded Gabo, the highest yielding standard variety, in yield. Pelshenke testing for gluten quality was considerably enlarged in its scope, and four new selections which are now available for regional testing were subjected to actual milling tests. Such tests placed one of these strains (K_2P_4—4620) in premium quality class, and a second (TSKPF—4601) as producing a straight bread flour of excellent balance and high quality. Florence x College—3813, a late maturing strain with high resistance to both leaf-rust and stem-rust, was submitted for naming as a new variety, and is recommended mainly as a dual-purpose variety for early sowing.

Varietal trials were carried out, mainly on the Darling Downs, but also in the Callide and Dawson Valleys. Results were variable, reflecting the influence of erratic seasonal conditions, but in most trials Gabo, Charter, Kendee, Fedweb 5 and Puseas were among the best.

Gabo was outstanding in yield and freedom from lodging, particularly in the Allora-Warwick section of the Darling Downs, but Kendee gave a slightly better general performance in the trials. Charter yielded well at Killarney and also at Mt. Tyson and Pirrinuan; Puseas also did well at the last two sites.

Within the slow maturing group, the Florence x College strains and Celebration yielded well, while Warput and Ford gave the best dual-purpose performances (early grazing followed by grain production) under dry conditions at Dalby.

New strains of stem-rust were reported to have been responsible for a breakdown in the resistance of such varieties as Gabo, Kendee, Charter and Yalta in southern Queensland and northern New South Wales. The field trials confirmed reports in regard to Yalta and Kendee but not in respect of Gabo, Charter or Fedweb 5. The Florence x College strains maintained their high resistance to both stem-rust and leaf-rust.

Wheat mottling investigations on the Darling Downs covered a wide field, including fertilizers, minor elements, crop rotations and grain analyses. Some years' work may be necessary before any definite conclusions can be drawn, but present indications are that mottled wheat does not always make poor flour, and that mottling cannot be explained simply as a result of low soil nitrogen.

A fertilizer trial at Tannymorel (mean yield, 25.21 bushels per acre) showed increased yields for nitrogen and for phosphate, but these increases were small. An analysis of the mottling percentages showed a significant decrease in mottling with the addition of nitrogen and a non-significant increase with the addition of phosphate. This suggests that the repression of mottling depends on a delicate balance between nitrogen and phosphate (Table 1). Another trial at Allora (mean yield, 33.7 bushels per acre) did not show responses to nitrogen or phosphate.

TABLE 1.
Wheat Fertilizer Trial.
Mottled Grain (Mean Percentages).

—	No Super.	80lb. Super. per acre.	160lb. Super. per acre.	Means.
No Sulphate of Ammonia ..	62·0	67·7	74·3	68·0
56lb. Sulphate of Ammonia per acre	46·0	47·7	61·0	51·6
Means ..	54·0	57·7	67·7	59·8

Oats.

Selection for rust resistance in hybrid material from the cross (Bond x Victoria) x Hajira, has been advanced a stage during a season of heavy rust infection. While none of the progenies tested showed any resistance to stem-rust, a number were highly resistant to crown-rust. The best of the resistant strains will be increased and made available for further grazing trials.

On the Atherton Tableland, in Central Queensland, in the Central Burnett, in the Beaudesert area and on the Darling Downs, the varieties Victoria x Richland and Fulghum x Victoria have proved to be resistant to crown-rust but susceptible to stem-rust, while the variety Klein has shown partial resistance to both rust species. Victoria x Richland is an early variety which has made a very favourable impression on farmers, particularly in wet coastal areas. Klein shows much promise as a variety to provide late feed.

Maize.

Selection has been continued within the varieties Improved Yellow Dent, Star Leaming, Golden Beauty, and Funk's Ninety Day for

PLATE 3.

A Linseed Varietal Trial at Ayr Regional Experiment Station.

PLATE 4.

Pineapples Planted on the Contour at Maroochy Experiment Station.

maintenance of varietal standards and provision of seed stocks to farmers. The replicated ear-to-row test within Star Leaming in 1948-49 showed significant differences in yield between progenies from individual ears. Remnant seed from the best six ears was therefore bulked and used to sow a small increase plot in the Mary Valley district.

In the 1948-49 Durum versus Dent trials on the Atherton Tableland, the average yields of the two varieties did not vary greatly (Durum 31.9 bushels per acre and Dent 31.4 bushels per acre). Disease, however, was slightly heavier in the Dent variety with 14.6 per cent. of cobs being diseased against 10.6 per cent. in the Durum variety.

Most of the plant nutrition investigations have been concentrated on the Atherton Tableland. A peanut-maize rotation trial on "forest" soil has been continued for four years. For each of the two years for which data are available there has been a substantial increase in yield from maize following peanuts over maize following maize—40 per cent. in 1948 and 32 per cent. in 1949 (Table 2).

TABLE 2.

PEANUT-MAIZE ROTATION TRIAL, ATHERTON TABLELAND.

Season.	Barren Plants and Yield.	Maize–Maize.	Peanuts–Maize.
1947–48 ..	% Barren Plants ..	10·7	4·4
	Grain (bus. per acre)	26·1	36·7
1948–49 ..	% Barren Plants ..	30·82	23·26
	Grain (bus. per acre)	23·82	31·46

Two green manure-maize rotation trials on "forest" and "scrub" soil respectively have been continued for three years. Data for the second year showed that on "forest" soil there was a 60 per cent. increase in yield where maize followed cowpea compared with maize following maize. On the "scrub" soil the increase of maize following cowpea was insignificant. These results, which are consistent with the fertility status of the respective soil types, are summarized in Table 3.

TABLE 3.

GREEN MANURE—MAIZE ROTATION, ATHERTON TABLELAND.

Soil Type.	Barren Plants and Yield.	Maize–Maize.	Cowpea–Maize.
"Forest" ..	% Barren Plants ..	29·18	16·25
	Grain (bus. per acre)	22·15	35·62
"Scrub" ..	% Barren Plants ..	17·51	16·78
	Grain (bus. per acre)	65·67	69·56

Three fertilizer trials were conducted on the Atherton Tableland. One, on "forest" soil, showed a marked response to nitrogen applied as sulphate of ammonia at 2 cwt. per acre. The grain yield increased from 27·37 bushels to 37·07 bushels per acre. There was no response to phosphorus or potassium. In the previous season, which was drier, a more marked response to nitrogen and a response to phosphorus were obtained. Following these marked responses, the residual effects of the fertilizer were investigated in 1949-50. There was no indication of any carry-over effect of the fertilizer, although the seasonal conditions may have had an important bearing on this result. On fertile "scrub" soil, no response to fertilizer was obtained (mean yield, 58·66 bushels per acre).

In the South Burnett two fertilizer trials were conducted on the red volcanic soils. One on "forest" soil responded to nitrogen and to phosphorus, and showed an interaction between these two nutrients, the response to either one being most marked when the other was present. The other trial was on the more fertile "scrub" soil and no responses were obtained (Table 4).

TABLE 4.

MAIZE FERTILIZER TRIALS, SOUTH BURNETT. MEAN YIELDS—BUSHELS PER ACRE.

Treatment.	"Forest" Soil.	"Scrub" Soil.
No sulphate of ammonia ..	50·05	61·0
1 cwt. sulphate of ammonia per acre	55·17	66·1
2 cwt. sulphate of ammonia per acre	57·67	64·2
No superphosphate	47·81	63·9
2 cwt. superphosphate per acre..	55·74	64·2
4 cwt. superphosphate per acre..	59·34	63·2
No sulphate of potash	54·17	65·7
1 cwt. sulphate of potash per acre	53·44	62·2
2 cwt. sulphate of potash per acre	55·27	63·4

Sorghums.

Plant breeding was continued at Kingaroy, progress being made in pedigree selection within hybrid families and some newer varieties. The most promising families at present comprise strains of Day Milo x Dwarf Kalo, Kafir x Milo and Wheatland x (Wheatland x Betty). Some fifty progenies from these crosses have reached a high degree of uniformity, and are being multiplied for replicated strain testing. Progenies from the Wheatland x Shallu cross still show considerable variability.

Results of the 1948-49 varietal trial at Kingaroy and the two trials harvested to date this season on the Darling Downs are summarised in Table 5. Because of early frosts the 1948-49 Gayndah trial gave no grain yields, but in a feeding-off test the stock showed a marked preference for Capricorn. The 1949-50 season favoured early maturing varieties on the Darling Downs. The Queensland selection from Early Kalo (E.K.1) has done well, and the recent American introductions, Martin, Plainsman and Caprock, have also proved reliable.

TABLE 5.

RESULTS OF GRAIN SORGHUM VARIETAL TRIALS IN BUSHELS PER ACRE.

Variety.	Kingaroy 1948–49.	Bongeen 1949–50.	Brookstead 1949–50.
Wheatland	47·5	39·0	21·4
Alpha (Wheatland 11S) ..	42·8	95·5	41·5
Caprock	40·1	74·9	25·8
Capricorn (Ex Early Kalo E.K.7)	38·6	71·2	24·3
Martin	21·2	92·1	43·5
Kalo	19·3	89·6	44·5
Hegari	16·6	..	..
Martin A	15·9	..	..
E.K.1	..	89·1	52·6
Plainsman	..	87·9	29·0

The new Queensland grain sorghum variety, Alpha, is now in limited use on farms, and will later be distributed throughout the State. A comparison in yield between Alpha and Wheatland in a series of varietal trials covering a four-year period is provided in Table 6.

TABLE 6.

ALPHA AND WHEATLAND GRAIN SORGHUM YIELDS.

Locality.	Year.	Yield (bus. per acre.)	
		Alpha.	Wheatland.
Biloela	1947	23·4	17·1
Hermitage	1948	36·7	15·0
Biloela	1949	34·3	29·7
Hermitage	1949	94·3	50·5
Kingaroy	1949	42·8	47·5
Brookstead	1949	79·2	75·4
Pittsworth	1949	35·6	44·3
Bongeen	1950	95·9	43·5
Brookstead	1950	41·5	18·9
Mean 1947–50		53·7	38·0

Within the sweet sorghum group, maintenance of pure strains of superior varieties to provide mother seed for seed certification areas is proceeding. In variety trials at Gympie, as in last season's trials at Mackay, the variety Honey was outstanding and it is best for the coastal area (Table 7).

TABLE 7.

RESULTS OF FODDER SORGHUM VARIETAL TRIALS IN TONS OF GREEN MATERIAL PER ACRE.

Variety.	Gympie Trial A.	Gympie Trial B.
Honey	15·0	19·2
Jones	14·0	16·1
Sugardrip	10·5	12·7
White African	10·3	13·7
Atlas	9·4	10·5
Italian	8·2	9·3
Saccaline	8·1	13·9

Prussic acid tests applied to pedigree selections from Roma Sudan grass indicate that one strain is markedly superior to all of the others with respect to low toxicity. There is a possibility of developing a strain of this variety which will be safe for grazing at all stages of growth. Similar tests being applied to pedigree selections of Sweet Sudan grass will be used as a major basis of selection in the purification of this new variety.

Sunflower Seed.

Further study has been made of the hybrid sunflower, Advance. Large seed increases of both male and female parent strains have been harvested, and a crossing plot established at Gatton Irrigation Research Station has assisted in the development of crossing technique. By planting both parent strains simultaneously in alternate pairs of rows, and fertilizing the female rows with superphosphate, the parents have been brought to flower at the same time, thus ensuring optimum conditions for crossing.

In a varietal trial at Toowoomba (Table 8), seasonal conditions greatly favoured the quick maturing dwarf varieties (of which both strains of Advance were impressive) in comparison with the slow maturing Giant Russian. Reviewing the last three seasons' work, it is clear that the varieties offering the best chance of good seed and oil yields on the Darling Downs are Giant Russian and Advance.

TABLE 8.

RESULTS OF SUNFLOWER VARIETAL TRIAL AT TOOWOOMBA.

Variety.	Lb. Seed per acre.	% Oil (solvent extract).	Lb. Oil per acre.
Advance (local seed) ..	1,008	25·4	260·2
Advance (ex Canada) ..	970	22·8	231·9
Mennonite	884	22·6	213·2
Sunrise	791	24·8	201·9
Giant Russian	717	24·6	175·4

Linseed.

A linseed fertilizer trial at Evanslea was hampered by unfavourable seasonal conditions and the yields were low. There was a suggestion that the increased yield of from 4·87 bushels to 5·58 bushels per acre as a result of applying 122 lb. superphosphate per acre may have been significant. The corresponding yields of oil were 95·42 and 112·58 lb. per acre.

In a rate of seeding trial at Pittsworth, using rates between 18 lb. and 32 lb. per acre, there was little difference in yields.

Experience in Queensland with linseed strongly suggests that time of planting is an important factor in yields. In a time-of-planting trial at Westbrook, the best yields came from the mid-June and mid-July plantings. There was much green growth at harvest time, due to the late rains, and pre-harvest seed losses were higher in the early than in the later sowings. Of all treatments, mid-July planting provided the best crop for mechanical harvesting.

Navy Beans.

No response to treatment was obtained in the phosphate fertilizer trial conducted on the eastern Darling Downs in the 1949 season. The mean yield was 30.6 bushels per acre.

Soybeans.

Further progress has been made at Kingaroy in the sorting out of soybean strains suited for seed production and others showing promise for green manure and green feed. Yield trials have been established, including the eight varieties selected as most suitable for mechanical harvesting.

Cowpeas.

Purification of Reeves cowpea is proceeding, and one progeny has been reserved for special increase. The best of a number of other hybrid selections are six strains from (Victor x Large White) x (Skewbald x Poona). These strains will be tested for wilt resistance in northern sugar-cane districts, with a view to liberating the best as a new variety.

Peanuts.

Two fertilizer trials designed to investigate the responses of peanuts to different forms of phosphate and to potash on a scrub and a forest soil were established in the Kingaroy district.

Potatoes.

Fertilizer trials conducted in the Lockyer, Fassifern, and Lower Burdekin Valleys have again shown that nitrogen is the plant nutrient most deficient in the potato soils of these districts. There were no indications of responses to either phosphorous or potassium (Table 9).

TABLE 9.

MEAN YIELDS OF FIRST GRADE POTATOES (TONS PER ACRE).

Treatment.	Ayr R.E.S.	Kalbar.	Woodbine, *via* Gatton.
No sulphate of ammonia ..	3·84	5·10	5·53
2 cwt. sulphate of ammonia per acre	4·52	6·85	5·94
4 cwt. sulphate of ammonia per acre	4·88	6·12	6·15

At Ayr the increased yields resulting from applications of 2 cwt. and of 4 cwt. sulphate of ammonia per acre were similar to the results recorded in the previous year.

The trial at Woodbine in the Lockyer, on an area which had previously been cropped to lucerne for some years, showed that good average yields were obtained and that fertilizers were of no benefit. This adds weight to the opinion that leguminous green manures or rotational crops will supply all or most of the nitrogen required for a succeeding potato crop in the Lockyer Valley potato soils.

Although the trial at the Gatton Irrigation Research Station gave good average yields without any clear response to fertilizer, there was a suggestion of a response to 2 cwt. sulphate of ammonia per acre. The mean yield was 5.8 tons of first grade tubers per acre.

Some interesting data were obtained from a trial at Gatton Irrigation Research Station following a fallow and the turning under of some green manures (Table 10). The highest yields followed a bare fallow and a good crop of field pea, while non-legumes had a depressing effect on yields. The trial was in an area where responses to added nitrogen have not yet been obtained, and it seems that the availability of the nitrogen in the soil here is of much greater significance than the total amount in relation to the potato crop.

TABLE 10.

MEAN YIELDS OF POTATOES (TONS PER ACRE) FOLLOWING BARE FALLOW AND GREEN MANURE.

Green Manure Crop.	First Grade.	Total.
Fallow	4·84	6·11
Field Pea	4·84	6·10
Peas and Wheat	4·53	5·66
Lupins and Weeds	4·09	5·21
Barley	3·84	5·10
Wheat	2·61	3·76

Spray irrigation again proved better than furrow irrigation in a combined irrigation and variety trial at Gatton Irrigation Research Station, the difference in yield of first grade tubers being .61 tons per acre. Although Sebago and Saranac both yielded better than the standard variety Factor, only the difference in favour of Sebago was significant. The mean yields were 6.02, 4.67 and 4.17 tons per acre for Sebago, Saranac and Factor respectively.

Bismarck, Saranac and Sebago gave significantly better yields than the standard variety Factor in a trial at Boonah. In the same trial it was shown that a 12 inch sett spacing gave a significantly higher total yield than either the standard 15 inch or an 18 inch spacing and that both 12 inch and 15 inch spacings were significantly better than the 18 inch spacing for yield of first grade tubers.

Bismarck also significantly outyielded Factor by more than one ton per acre in a variety trial at Ayr.

Sweet Potatoes.

In a trial at Mackay the varieties Porto Rico (13.0 tons of tubers per acre), White Maltese (11.2 tons), and Abundance (11.2 tons) were the best yielders. Porto Rico and Abundance are both excellent for cooking purposes.

Onions.

Storage tests indicated that brown onions stored better than white types, that immediate pre-harvest conditions were important in storage capability, and that onions from heavy clay loam behaved similarly in storage to those from light sandy clay loam, the other soil type used. A varietal trial has been planted at Rockhampton and a varietal x time of planting trial at the Gatton Irrigation Research Station.

Tobacco.

New pure seed stocks have now replaced all previous stocks, and bulk seed of the new varieties Hicks, Yellow Special, 400, 401 and 402 have been made available to farmers to supplement older established varieties. Other work on tobacco is discussed under the heading of "Tobacco Experiment Farms."

Cotton.

Pedigree selection and strain building have been continued within jassid-resistant back-cross selections, and strains of the commercial varieties Miller, New Mexico Acala and Triumph. In a season in which jassid attack was more severe than for many years past, the resistance of the Miller back-crosses to this pest was most striking. The best strains within this group combined jassid resistance with uniformity, open fruiting habit, and suitability for mechanical harvesting.

Unusually severe frosts in June, 1949, caused unsatisfactory results again from the various trials in the Lower Burdekin.

The results of the 1948-49 trials did not provide a reasonable comparison between varieties except at Gatton Irrigation Research Station. Although the average yield here was 1,563 lb. seed cotton per acre, there were no pronounced differences between varieties.

Lucerne.

A fertilizer trial at Bunjurgen, near Boonah, showed a significant response to gypsum on green weights, but not to any other sulphate. Superphosphate, potash and some trace elements were also without effect. The average weight of green material per acre was 5.02 tons. A similar trial has been established at Beaudesert with the principal object of further investigating the effect of sulphur-bearing soil amendments.

TOBACCO EXPERIMENT FARMS.

Experimental work was continued at Mareeba, Ingham, and Ayr, but because of shortage of skilled labour a reduced programme was undertaken at Ingham and grading of leaf was omitted. Appraisal values for the leaf from Mareeba and Ayr for the 1949-50 trials have not been received, so final analyses of the data cannot be given here.

As in the previous year, facilities were provided at Clare Tobacco Experiment Farm for investigations by officers of C.S.I.R.O. into problems associated with plant breeding, water requirements of the crop, and leaf quality determinations.

Mareeba.

No significant differences between treatments appeared when the 1948-49 fertilizer trial results were examined on the basis of appraisal values.

In the muriate versus sulphate of potash trial, the chlorine content of the leaf was higher for muriate than for sulphate in the case of lugs and tips, but was lower for muriate in cutter leaf.

There was no difference in value per acre between tobacco grown with nitrate of soda as the inorganic nitrogenous fertilizer and that grown with sulphate of ammonia, indicating that in this trial the former had no special influence on leaf quality.

A fertilizer trial and a varietal trial were grown in 1949-50, and the crop rotational experiment already established was continued. A further rotational trial involving peanuts, cotton and velvet beans as well as tobacco was set out. Tobacco plants made good growth in each case following Gambia pea, Rhodes grass and maize. General progress in the varietal trial was satisfactory, the average yield being 1,403 lb. of leaf per acre.

Abergowrie College, Ingham.

Appraisal values for the leaf from the 1948-49 trials showed that the highest nitrogen application returned the highest value per acre in the fertilizer trial, while in the varietal trial, Yellow Special, Yellow Mammoth and 402 gave the best monetary returns.

In the fertilizer trial and the varietal trial for 1949-50, analyses of total plot yields showed no significant differences.

Clare, Ayr.

Yellow Special and Hicks were the best varieties when the 1948-49 leaf was analysed on appraisal values, but no significant differences between treatments were shown in the fertilizer trial.

Chemical analyses of leaf which had been sprayed with DDT weekly during its growth indicated that the chlorine content of the leaf was not increased by this treatment. Samples of sprayed leaf averaged 0.8 per cent. chlorine and of unsprayed 1.0 per cent.

Trials in 1949-50 included investigations of irrigation methods, examination of soil types other than the Burdekin fine sand with regard to suitability for tobacco growing, and the continuation of the crop rotation trial which had already been established.

There were no appreciable differences between furrow and spray irrigation methods based on yield figures alone. From observation pilot plots on Landers sandy loam, Clare loam and Clare sandy loam compared with Burdekin fine sand, yields of good saleable leaf were 1,466 lb., 1,487 lb., 1,771 lb. and 1,600 lb. per acre respectively, indicating that all these soil types are suitable for tobacco growing. The rotational trial made excellent progress and gave an average yield of 1,832 lb. per acre. It is considered that this phase of the investigations is most important in relation to the stabilisation of tobacco growing in the Lower Burdekin.

BUREAU OF TROPICAL AGRICULTURE.

Pasture investigations have been continued, completing the fourth year of trials with grazing animals and the second year over which the liveweight gains of animals have been recorded. Other activities have included rice, tea and fibre plant investigations.

Pastures.

The year was rather dry, especially between July and December, but approximately 102 inches of rain fell from January to May inclusive, resulting in lush growth of pastures and some harmful waterlogging of the cultivated fields.

Wide variations are now beginning to show up in the pasture treatments. The mixture of molasses grass and puero (*Pueraria phaseoloides*), which has given good results to date, is now deteriorating. The mixture of purple topped Guinea (*Panicum maximum* var. *coloratum*) and centro (*Centrosema pubescens*), however, gave better results than any other treatment this season and looks very well.

The established pasture mixtures have made excellent growth at Utchee Creek, but shortages of labour and material have continued to be a problem. It is hoped that the large scale grazing trial will be commenced next year.

Rice.

The highest yielding variety in the varietal trial (see Plate 6, facing page 28) was Q2309 (59 bushels of paddy per acre), while in a trial at Tully Q2461 with 45 bushels of paddy per acre performed well under upland conditions. Sufficient data have been accumulated over the last three seasons to enable some of the less desirable varieties to be discarded. Those which do not hold their grain well when mature and those which lodge badly are considered unsuitable.

The 1949-50 varietal trials, harvest results of which are not yet available, have been restricted to nine varieties and it is expected that this number will be further reduced for

next season. Areas to provide bulk seed for distribution to approved farmers were planted and harvested.

Tea.

A considerable amount of information has been accumulated from the tea harvesting trial (see Plate 5, facing page 28). The quality of the tea produced has exceeded expectations and the product, though made with improvised manufacturing equipment, has been well commended by trade tea tasters.

On the basis of harvesting results from the trial, one man can harvest 4½ lb. of freshly plucked leaf equivalent to .9 lb. of black tea per hour; that is, under the labour conditions at the Bureau it costs 3s. 11d. to harvest a pound of commercial tea. With more experienced labour and piecework rates, this cost could be reduced appreciably.

It seems clear that the cost of harvesting will be the limiting factor in any future development of the tea growing industry in North Queensland. Mechanical harvesting equipment has been ordered, and this will be used to examine closely the prospects of solving the labour problem in tea harvesting.

Fibre Plants.

Small plots of two varieties of jute (*Corchorus capsularis* and *C. olitorius*) were planted, but the crop did not thrive in the waterlogged soil. A plot of kenaf (*Hibiscus cannabinus*) was also planted; these plants survived the wet soil conditions which had been so harmful to the jute. An observation plot of pink burr (*Urena lobata*) is to be planted with the other fibre plants for comparison. The ramie plants were again injured by Rhyparida beetle, resulting in stunted growth.

GULF EXPLORATORY FARM.

Despite numerous supply difficulties, an exploratory farm was finally established on 100 acres of plain country leased on Wrotham Park, about 60 miles north-west of Chillagoe. During the first year's operations, 25 acres of land were broken up and sown with various fodder crops, mainly of the sorghum group. The main interest is centred on how long into the dry winter and spring the several plantings (especially that of early April) will provide succulent feed superior to the natural pasture.

The major indications from the first year's work are:—(1) successful cropping on virgin land requires good seed-bed preparation to overcome the prolific regrowth of Flinders grass and to promote thorough decomposition of dry pasture residues in order to avoid soil nitrate irregularities; (2) although the soil is deficient in phosphorus, superphosphate applications at the rate of 112 lb. per acre did not benefit sorghum, but Flinders grass, Poona pea and native pasture legumes gave very pronounced yield increases; and (3) cultivation resulted in a much greater body of feed being available per acre than was the case in adjoining pasture. More than ten tons of green matter per acre was provided by fodder sorghums planted in January, compared with less than three tons from unfertilized natural pasture. Some January planted grain sorghum plots yielded at a rate exceeding 40 bushels of grain per acre.

In addition to the work on the exploratory farm, the Department was interested in a number of trial plantings of fodder crops on cattle and sheep stations in the drier areas south of the Gulf of Carpentaria. The results were spectacular in many cases, but there were some failures; these were mainly due to the selection of sites unsuitable for cultivation or to faulty seed-bed preparation.

FODDER CONSERVATION.

A number of silos, both pit and tower types, were constructed through the medium of the services provided by the Department, and three tower silos for grain storage on the farm were included in the number. The demand for these services from farmers remained steady, but the wet summer in most dairying districts did not favour silo construction.

The need for fodder conservation measures, especially on dairy farms, was publicised at field days, at numerous country shows by the display of exhibits and in published articles. Shortages of labour and machinery, however, continue to retard the expansion of fodder conservation. Farmers have shown little activity in the formation of machinery pools.

Report of the Horticulture Branch.

Dr. S. A. Trout, Director of Horticulture.

CROP PRODUCTION.

Pineapples.

Pineapple plantings showed an upward trend and the 1950 harvest is expected to be nearly two million cases. During the summer, heavy rains upset plantation operations, but a good winter crop is expected.

The relatively high returns obtained from the crop have attracted many new growers into the industry, and a heavy demand is being made on advisory services. Yields are lower than they should be owing to the excessive use of inferior planting material, but the pineapple selection work has now reached a stage where limited amounts of high-quality planting material can be distributed.

Sodium pentachlorphenate proved to be an effective weedicide and should ease the weed problem during the summer months when wet weather interferes with cultivation.

Studies in the physiology of flower induction and pineapple nutrition were continued. It may be noted that the synthetic hormone alpha naphthalene acetic acid has now largely replaced acetylene in the commercial control of flowering.

At the Ayr Regional Experiment Station, an area of 29 acres has been assigned to pineapples. The crop will be grown under irrigation and managed on a rotational system with a five-acre planting each year. Three of these will form a part of commercial planting from which costing data can be obtained; the other two will be used for experimental work designed to show how the crop should be handled in North Queensland.

Bananas.

The banana industry shows no signs of returning to its output of a decade ago and current plantings are not sufficient to maintain the acreage under crop. In 1950, the area under bananas was 12,862 acres, compared with 13,517 acres in 1949.

The northward spread of bunchy top has apparently been checked. Plantings of tall varieties susceptible to Panama disease are now permitted only after the source of planting material has been inspected.

Current research work on the crop is mainly concerned with the control of bunching. The aim is to determine whether the depth of the offshoot or the time at which it is thrown in terms of season and the age of the parent plant has any bearing on growth and fruiting habits in ratoon crops.

Considerable interest is being shown in the possible value of hormone weedicides for the destruction of old plantations.

Papaws.

The 1949 spring harvest opened with a heavy crop of well-shaped fruit, but first quality papaws were not available until warm weather reduced the wastage from fruit rots and improved the colour of the rind and flesh.

Pure seed of the Departmental varieties Bettina and Improved Petersen was distributed to growers in spring by the Queensland Acclimatization Society. The demand far exceeded the available supplies and the position will not be satisfactory until the pure-seed area at Redlands comes into bearing. Both varieties are now being tested in all papaw producing districts.

In a trial at Maroochy Horticultural Experiment Station, heavy dressings of lime were associated with star cracks on the skin of the fruit. Similar blemishes have been recorded elsewhere in commercial plantations. It is now considered necessary to use lime only on very acid soils.

Deciduous Fruits.

The deciduous fruit season opened well with good spring rains in the Granite Belt and a very heavy blossoming in both pome and stone fruits. Subsequent conditions were unbalanced, dry weather in November and December being followed by excessive rains which lasted well into the autumn. Shedding was, therefore, heavy and the crop harvested was little better than normal.

At Stanthorpe, plantings in 1949-50 exceeded 1,000 acres, but the majority of these plantings were on replant land. Good orchard management and correct soil treatment will be needed if replant orchards are to pay their way. In coastal districts, plantings of the Muscat Hamburg variety of grapes for the early market are greater than usual.

Apple rootstocks released by C.S.I.R.O are now being made available to growers through the Deciduous Fruit Sectional Group of the C.O.D. Three new stocks of particular interest are Merton 778, Merton 793 and Merton 789, all of which should prove better than Northern Spy for the important varieties of apple grown at Stanthorpe. Merton 789, however, is not recommended for Jonathan.

Citrus.

Rind blemishes due to Maori mite and melanose were more severe than usual, but the local market has been well supplied with good fruit. Queensland-grown mandarins are exceptionally good and growers have a competitive standing in southern markets which they cannot acquire with oranges, except perhaps very early in the season. An expansion of the area under mandarins and an extension of the harvesting period are desirable. New and improved varieties would do much to bring this about and breeding work on these lines has therefore begun.

The citrus budwood scheme operated satisfactorily during the year, approximately 100,000 buds and 187 lb. of seed having been supplied at a relatively low cost to nurserymen. Current orders indicate a trend away from rough lemon as a rootstock for some types of citrus.

Observations were made on a frost protection project in a nursery at Mundubbera. Frost protection by oil burners is not economically sound, but good results were obtained by a light sprinkler irrigation when temperatures fell

below 28°F. The effect of such irrigation is probably due partly to the relatively high temperature of the river water used and partly to the prevention of ice formation on the leaves.

Many citrus soils are singularly short of organic matter and a number of summer green manures were, therefore, studied at Gayndah and at Howard. Good crops of L.W.S.M. and some other newly developed strains of cowpea were grown, but the more woody Crotalarias, with the possible exception of sunn hemp, proved unsatisfactory. The use of green manures in bearing orchards may interfere with cultural operations and the crop sometimes competes with the trees for the available soil moisture. Greater interest is, therefore, being shown in mulching techniques. Work done on this subject suggests that heavy mulching with a bulky crop grown outside the orchard and carted onto it at the end of the wet season has distinct possibilities.

Avocadoes.

The current season's avocado crop has been better than usual, the fruit being well filled and very attractive. Field observations show that irrigating the variety Fuerte when the crop sets in spring increases yields considerably.

The avocado industry is still relatively young and the main requirements for the development of the industry are a more certain method of propagation, careful selection of soils for the orchard, and a consumer awareness of the stage at which the fruit should be eaten. These matters are receiving attention.

Miscellaneous.

The current season's crop of Macadamia nut has been good in most districts, with little damage from insect pests and generally a high quality nut. Existing plantations are based on seedling trees, each of which differs from its neighbour in habit of growth, the type of nut borne and its cropping potential. Work on the crop, therefore, aims at selecting trees of superior strains and devising suitable propagation methods.

Commercial production of custard apples is confined to the metropolitan district and most growers have a long experience with the crop. There is an increased interest in the crop at Redlands, where tall varieties of bananas are becoming unprofitable owing to the high incidence of Panama disease.

Fig growers had an excellent season in the metropolitan district, where both White Adriatic and Brown Turkey came through the wet season with little injury from either pests or diseases.

Strawberries.

Yields from the strawberry crop in 1949 were heavy and the quality of the berries well up to average. Markets for fresh fruit opened up by air transport and a steady, unsatisfied factory demand ensured payable returns to the grower. Growers are increasingly conscious of the fact that a good crop can only be expected from runners taken from plants which are free from yellow edge or crinkle virus disease. There is accordingly a heavy demand for runners from crops approved by the Department as sources of planting material.

Strains of the main commercial variety, Phenomenal, differ in their times of maturity and their productivity. An area has therefore been planted at Redlands Horticultural Experiment Station for the purpose of selecting a uniform type of plant without which experimental work on fertilizer requirements and cultural practices cannot be satisfactorily carried out.

Tomatoes.

During the current season diseases caused heavy losses in both the seed-bed and the field. At times, the market was undersupplied and much inferior fruit was offered for sale.

The certified varieties, Q1, Q2, Q3 and Q4, released by the Department in 1949, performed well. The demand for seed of the early maturing type Q1 was very heavy. Although specially recommended for the Stanthorpe district, all four varieties have been grown extensively elsewhere. Many growers are using the certified seed as a source of planting material from which they can make selections adapted to their own soil type. About 1,750 oz. of certified seed of Q1, Q2 and Q3 produced during 1949-50 are available for the coming season. The crop grown for Q4 seed failed to comply with the prescribed standards.

Under some conditions, all the more important tomato varieties show defects. Factors associated with these disorders are being investigated.

Leaf Vegetables.

So far, 1950 has been a bad year for leaf vegetable crops, mainly owing to losses in the seed-beds during the wet late summer and autumn. The few early crops harvested were characterised by small heads of indifferent quality. Mid-season crops promise reasonably well.

During the past two years, several varieties of cabbage and cauliflower have been under test and recommendations for both crops have been made. The Snowball strains of cauliflower showed up well in the trials. The lettuce variety position is also reasonably good, at least for the cool weather crops.

Beans.

In 1950, early crops encountered very wet weather. Faulty land preparation was common and field losses were high. However, mid-season crops bore very well and excellent beans were marketed.

Bean production continues to expand in southern Queensland, mainly because air freight services have opened up more distant markets. Departmental work on the crop has standardised varietal usage and fertilizer practice. There is, however, considerable room for improvement in both yield and quality of the Brown Beauty bean. Strains of widely different vegetative and fruiting character have therefore been selected and the best of them will soon be built up as mother seed for certified crops, thus increasing the types being certified.

Pepper.

The recent upward price trend of pepper suggests that the State should produce its own requirements. Planting material is not available here and steps have been taken, therefore, to obtain both seeds and cuttings from Malaya.

HORTICULTURAL EXPERIMENT STATIONS.

Maroochy.

The mass selection project in pineapples covers about ten acres of land and severe culling has been necessary to maintain and improve plant type. This work has now been supplemented by clonal plantings, the study of which should supply information on the stability of inheritance within the type.

The citrus area assigned for the production of budwood and the study of stock-scion relationships has made good progress.

The papaw breeding block occupies about an acre of ground. The present pure types will be maintained; some others will be purified further; and the possibilities of using hybrid vigour in the crop will be investigated.

Approximately two acres of bananas were planted in 1949, and the first bunches should be thrown in spring. Experimental settings of the followers will begin shortly and should show the effect of management methods on both the cropping capacity and the commercial life of the plantation.

Plantation crops are now planted on the contour (see Plate 4, facing page 20), but this may not be a complete solution of the problem of hillside farming. A compromise between contour and sectional drains may be the outcome of soil conservation studies on the pineapple crop.

Mulching is becoming a standard practice and the system of station management is being modified accordingly. Land which is not suitable for horticultural crops has been set aside for the production of mulch crops.

Redlands.

Four acres are under crop and another four should be added during the coming year. Two acres are allocated to an experiment in which the effect of leaving crop residues on the top of the ground is compared with normal cultivation practice. The cropping sequence on this area gives ample scope for varietal trials with the more important vegetable crops.

A papaw strain trial was planted in autumn in conjunction with supplementary trials established elsewhere.

Kamerunga.

On this experiment station, problems associated with fruit and vegetable production in the tropics are being investigated. Much of the land is still being reconditioned, but valuable collections of mango and papaw strains are maintained for detailed study. Two tomato trials carried out during the year demonstrated that many southern varieties cannot tolerate northern tropical conditions. The need for disease resistance in all fruits and vegetables grown in the humid tropics is a paramount consideration in this type of work.

About one acre of land cleared on the southern boundary will be planted shortly with rough lemon trees to supply the seed requirements of nurserymen.

REFRIGERATED TRANSPORT.

Tests have been carried out in conjunction with C.S.I.R.O. to determine the insulating properties of a four-wheeled A.B.G.F. railway wagon with an approximate tare of five tons and an eight-wheeled C.M.I.F. wagon with an approximate tare of ten tons. The wagons have been proved to be suitable for carrying fruits and vegetables over long distances provided they are regularly re-iced. Although cooling occurs during transit, a marked improvement in condition over non-refrigerated consignments cannot be expected unless the load is adequately precooled before loading.

STORAGE TESTS.

Citrus.

Storage tests were carried out with Late Valencia oranges to determine whether the marketing period could be extended by cool storage. Low temperature injury developed after one month at 40 deg. or 45 deg. F.

Cool storage treatments have been found to be an effective means of killing fruit fly in infested apples, but it would appear from preliminary investigations with Emperor mandarins that the recommended treatment of 12 days at 34 deg. F. results in severe skin injury.

Onions.

Considerable quantities of onions are exported interstate and overseas, and storage tests were therefore carried out in conjunction with field trials of the Agriculture Branch. The conditions of storage were equivalent to those in unrefrigerated cargo spaces in which foodstuffs are carried to countries north of Australia.

Varietal differences in storage behaviour were noted, the brown being superior to the white type of onions. Weather conditions prior to harvesting, and treatment between harvesting and storage, had a considerable influence on storage behaviour.

WASTAGE.

Citrus.

Citrus fruits grown in Queensland appear to be particularly susceptible to mould development, and heavy losses occur during local marketing. Trials carried out in conjunction with the Science Branch indicate that wastage can be considerably reduced by dipping the fruit in a solution of borax or salicylanilide. The former treatment, however, caused severe skin injury. Further tests are in progress.

Bananas.

Abnormal ripening of bananas characterised by rubberiness occurs in winter ripened fruit in southern plantations and has recently been recorded in summer grown fruit and in northern districts. The available evidence indicates that the condition is confined mainly to the first cut from plants grown on virgin scrub or forest soil. Investigations are being

PLATE 5.

Harvesting Tea at the Bureau of Tropical Agriculture, South Johnstone.

PLATE 6.

Upland Rice Varieties at the Bureau of Tropical Agriculture, South Johnstone.

planned to determine whether soil conditions are a contributing factor or whether abnormal ripening is associated with any chemical or physical constituent or with enzyme activity.

Pineapples.

Conditions during the summer were extremely favourable for the development of water blister, and large losses occurred in interstate consignments and in factory fruit which could not be processed on the day of arrival. More growers are adopting the recommended control measures. A colour film illustrating the correct methods of harvesting, handling and packing for various markets and for the factory has recently been made. It is hoped that visual instruction will form an integral part of extension activities.

Further investigations have been made on factors associated with the development of black heart. This form of cold injury can be induced by severing portion of the stem of the fruit; the affected portion has a lower carbohydrate content than the healthy tissue. No difference in black heart incidence between fruit borne on healthy and unhealthy plant crops has been noted, but in the ratoon crop significantly less black heart affected fruit was borne on healthy plants. Cultural conditions are important, and the effect of trace elements is now being investigated. Black heart incidence was not affected by ripening conditions after harvesting. The rate of fall in temperature during growth appears to be of greater significance than the mean minimum temperature.

MATURITY INVESTIGATIONS.

Grapes.

Trials involving chemical and tasting tests on five varieties of grapes picked at different stages of maturity from a number of orchards in the Stanthorpe district and carried on for three seasons, have now been completed. The prescribed standard is based on the density of the expressed juice, and this has been related to sugar content and to palatability. The standard of 1.066 may have to be raised for the sweeter varieties.

Citrus.

Physical and chemical measurements and palatability tests have been made on citrus fruits picked from the more important districts over several seasons, and although acid values of the 1950 crop were low the samples were not acceptable on a palatability basis until after the main crop had been marketed. The slow development of flavour and the relatively low acid content this year were probably associated with abnormally heavy rains during growth.

Pineapples.

Further investigations have indicated that both the winter and the summer crops are normally harvested at a stage of maturity which complies with the prescribed colour and sugar standards. There was a significant correlation between total solids as determined by the Brix hydrometer or refractometer and the total sugar content estimated chemically. Readings, however, must be taken on the expressed juice of the whole fruit.

RIPENING.

Bananas.

Further observations have been made on methods of ripening bananas, with particular reference to the control of conditions during the early stages of ripening. Some of the methods employed commercially are costly and result in excessive weight losses.

Papaws.

The artificial ripening of papaws, employing higher temperatures than those used for bananas, is being used extensively for the winter crop. By this method, skin blemishes which develop when the fruit is allowed to ripen slowly on the tree can be largely avoided and the harvesting can be spread more evenly. Observations are being made in conjunction with commercial ripeners on the optimum stage of maturity and other factors influencing quality.

PROCESSING.

Canning of Bananas.

The value of various anti-oxidants in preventing the darkening of bananas during canning is being investigated and recent results are of distinct promise. The bananas maintained their fresh colour, texture and flavour after canning, but storage tests are necessary before commercial application can be recommended.

Pickling of Onions.

Due to abnormally wet conditions preceding harvesting, considerable losses in pickling onions occurred because of incorrect processing methods. Overseas methods are not applicable to Queensland, where conditions during summer result in rapid spoilage. Bacterial action can be completely arrested by holding in a 20 per cent. salt solution. However, in order to obtain an attractive and well flavoured article, curing in lower salt solutions is necessary to enable lactic acid fermentation to proceed. For this purpose a 10 per cent. salt solution has been recommended, but in tests only 0.2 per cent. lactic acid was obtained after six weeks treatment. Further investigations will be made with lower salt concentrations.

QUICK FREEZING OF TROPICAL FRUITS.

Preliminary experiments on methods of preserving pineapples and bananas by quick freezing methods have been completed. The selection of fruit at the optimum stage of maturity is more important for quick frozen than for canned foods. The latter process can develop latent flavours in immature fruit and destroy over-ripe flavours in very mature fruit. In quick freezing, abnormal and objectionable flavours frequently develop in both immature and overmature fruit. The results have indicated that prompt and rapid freezing at –20°F. is necessary to obtain a pack of good texture and colour, while the addition of sugar improves the flavour. The addition of ascorbic acid or other anti-oxidants is necessary to prevent darkening, especially in fruits such as bananas which discolour very rapidly on cutting. Overseas markets are at present available for all processed foods, and quick freezing offers distinct promise as a means of transporting tropical fruits. A considerable

saving in tinplate could be effected, as quick frozen products are packed in cellophane lined cartons. Quick freezing as a means of concentrating fruit juices warrants investigation.

PACKING.

Packing Instruction.

The presentation of commercial packs shows considerable improvement as a result of Departmental instruction in methods of handling and packing. The difficulty of transporting pineapples to western Queensland towns has now been largely overcome by selecting fruit for these markets from growers approved under the Special Pack Scheme. In conjunction with the Department of Public Instruction, a further series of school packing classes is being held in the Maroochy district.

Cardboard Packages.

Acute shortage of timber for casemaking has necessitated attention being given to cardboard packaging. A container made of heavy cardboard, weighing approximately 3 lb., and of the same size, measurement and capacity as a half-bushel dump case, has proved satisfactory for the carriage of tomatoes from Stanthorpe to Brisbane. The case requires no nails and has the additional merit of being collapsible and returnable. Tests are being made on railings to Sydney with the winter crop of tomatoes.

EXPORTS OF FRUITS AND VEGETABLES.

During 1949-50, major exports through the port of Brisbane were 44,355 cases of apples and 2,800 cases of citrus. The quantity of apples exported is approximately 10,000 cases more than last year, due mainly to a larger crop of Granny Smith apples and to very favourable overseas markets. Most of the consignments are being carried in refrigerated holds and the out-turn is very much better than in unrefrigerated spaces. Only a small quantity of pineapples has been sent to New Zealand this year, as most of the crop has been canned. Considerable quantities of frozen strawberries and pineapples were consigned overseas, the amounts being 336 4-gallon tins of frozen strawberries, and 3,122 4-gallon tins and 18,795 cartons of frozen pineapple.

Regulations have been drafted for pineapples, restricting export to approved packing establishments and prescribing methods of harvesting and packing.

MARKET INSPECTION.

Heavy rains prior to harvesting caused large losses from moulds, particularly brown rot, and considerably affected the quality of many fruits. Condemnations therefore were particularly heavy, especially for stone fruits and tomatoes. Grade standards for all fruits and vegetables of commercial importance in Queensland have now been drawn up and their introduction should improve the standard of produce marketed. Wall sheets illustrating the requirements of the Regulations under the *Fruit and Vegetables Act* are being prepared for circulation to growers and distributors.

QUARANTINE.

Additional quarantine officers have been appointed to cope with inspection of the large quantities of plant material being imported into Queensland. Quarantine regulations have been drawn up for cotton, timber and nursery stock.

INTERSTATE TRADE.

The following quantities of fruit and vegetables were exported to and imported from other States during the year:—

EXPORTS.

Commodity.	Quantity.
Apples	85,069 cases
Avocadoes	2,745 cases
Bananas	109,285 cases
Custard Apples	9,310 cases
Grapes	47,494 cases
Lemons	6,060 cases
Mandarins	5,050 cases
Mangoes	40,653 cases
Melons	13,776 cases
Oranges	11,388 cases
Papaws	42,710 cases
Passion Fruit	3,760 cases
Pears	2,193 cases
Pineapples	450,791 cases
Strawberries	618 trays
Fruit (Various)	23,246 cases
Grape Fruit	4,456 cases
Citrus (Various)	50,296 cases
Beans	141,595 cases
Beetroot	23,492 cases
Cabbages	15,892 bags
Carrots	4,915 bags
Chillies	660 cases
Chokos	1,858 cases
Cucumbers	75,762 cases
Ginger	3,156 bags
Marrows	30,319 cases
Onions	169,632 bags
Peas	5,580 cases
Plants	1,042 cases
Potatoes	74,851 bags
Pumpkins	226,314 bags
Seeds	1,785 bags
Sweet Potatoes	22,805 bags
Tomatoes	512,391 cases
Vegetables (Various)	12,454 bags
Peanuts	75,373 bags

IMPORTS.

Commodity.	Quantity.
Apples	235,496 cases
Apricots	57,643 cases
Cherries	24,934 cases
Grapes	14,644 cases
Lemons	14,339 cases
Nectarines	3,013 cases
Oranges	126,956 cases
Passion Fruit	1,353 cases
Peaches	33,912 cases
Pears	74,942 cases
Plums	19,699 cases
Fruits (Various)	64,825 cases
Bananas	6,684 cases
Bananas	6,282 bunches
Citrus (Various)	19,326 cases
Beans	18,235 bags
Beetroot	275 bags
Celery	3,940 cases
Carrots	23,496 bags
Nuts (Various)	252 bags
Onions	75,469 bags
Peas	44,771 bags
Plants	3,327 cases
Potatoes	325,029 bags
Seeds	35,180 bags
Swede Turnips	2,884 bags
Tomatoes	12,223 cases
Vegetables (Various)	5,677 bags

Report of the Bureau of Sugar Experiment Stations.

Mr. N. J. King, Director of Sugar Experiment Stations.

CROP YIELDS.

The 1949 crushing amounted to 6,518,042 tons of cane. This was 384,000 tons in excess of the 1948 crop and constituted a new record of production for the State. However, the acreage harvested was 17,000 higher than in the previous year and the production per acre dropped to an average of 23·7 tons. Sixteen of the thirty-two mills exceeded their 1949 peak quotas and six mills experienced prolonged crushings extending into January. The last cane was crushed on 13th January.

Once again the major proportion of the crop was produced by Queensland-bred cane varieties (Table 1). These aggregated 59·2 per cent. of the tonnage crushed and for the first time Badila was supplanted as the major variety, being second to Trojan. C.P. 29/116, Q.28 and Q.50 were the next three in order of importance. Trojan and Badila were both over the one million tons mark, while the other varieties mentioned all exceeded half a million tons. Although Trojan and Q.28 have probably reached their peak of production, further increases in the tonnages of Q.50, Pindar and Q.47 may be expected, and it is anticipated that the proportion of Queensland-bred canes will continue to increase.

TABLE 1.

Composition of 1948 Crop on basis of Countries of Origin.

Country of Origin.	Tonnage Harvested.	Percentage of Crop.
Queensland	3,855,844	59·2
New Guinea	1,103,609	16·9
U.S.A.	800,213	12·3
Java	503,047	7·7
India	128,447	2·0
Mauritius	86,903	1·3
West Indies	25,087	0·4
Fiji	14,892	0·2
	6,518,042	100·0

VARIETAL TRIALS.

At Mossman, Whiterock and Gordonvale, Q.50 performed very well to outyield Comus, Trojan, Eros, Cato, 41 M.Q. 779, and several "Q" canes. In the Innisfail area, Eros was superior to Trojan on seven farms in the first ratoon crop, but in the aggregate of the two harvests Trojan exceeded Eros by 6 per cent.; both were superior to Q.54.

In the Lower Burdekin area, Pindar outyielded Badila and B.212 in tons of sugar per acre on three farms, while Pindar, Trojan and H.Q. 426 were not separated significantly. In other series of trials, Trojan was superior to B. 331, E.K. 28, Q.44 and S.J. 16, while Q.45 outyielded Q.28, Q.50, Eros and E.K.28.

The Proserpine and Mackay trials resulted in an unmistakable success for Q.50, except in one experiment, where C.P. 29/116 was the best variety in both cane and sugar. In this trial, C.P. 29/116 was the only cane to resist a heavy red rot infection.

At Bundaberg, several trials showed Q.50 in a favourable light in terms of sugar per acre, although C.P. 29/116 produced the most cane. On Bingera Plantation, Q.47 produced 6·07 tons of sugar per acre in a 14 months' trial, this yield being superior to that of Atlas, Q.49, Trojan, Q.44 and P.O.J. 2878. At Nambour, C.P. 29/116 exceeded Q.28, Q.47 and P.O.J. 2878 in one series of trials, while Vesta was superior to Q.47, Q.49, Akbar and P.O.J. 2878 in another.

EXPERIMENT STATION ACTIVITIES.

Seedling Propagation.

The normal programme of cross pollination was carried out at Meringa and the three stations raised and planted out the usual complement of seedlings. In addition, the new station in the Lower Burdekin district began activities with seedlings supplied from Meringa.

The seedling sub-stations at Bartle Frere (Babinda), Lansdowne Road (Mackay) and Beerwah were continued. At the first two, selections and progressive trials were carried out, but some further time must elapse before final selections reach the stage of being propagated. At Beerwah, the first seedling introductions were made in 1949, and these will enter the Moreton area for farm planting during 1950.

Meringa Sugar Experiment Station.

Work on this station has proceeded on similar lines to the previous year in both cane breeding and entomology, but emphasis has been laid on more particular problems. The control of the greyback grub by benzene hexachloride is now an accomplished fact where recommended dosages and methods of applications are adhered to; current investigations include further work on placement, residual toxicity and the use of 20 per cent. instead of 10 per cent. dusts. The more pressing problem at the moment, however, is the control of frenchi and other two-year-cycle grubs. Early results indicate that frenchi first instar larvae are controllable with the normal benzene hexachloride application, but more work is necessary to develop a control of the third stage grubs.

In the cane breeding work, success has been achieved in the development of quarter-robustum seedlings with higher than average early sugar, and certain of these canes have performed sufficiently well to justify field scale propagation. This development is worthy of comment, since it is generally necessary to dilute wild blood to one-eighth before favourable sugar content is obtained. The retention of one-fourth wild blood improves the chances of maintaining high vigour and of retaining resistance to certain diseases.

Lower Burdekin Sugar Experiment Station.

Since the first requirement of the new station is to produce seedling canes suited for the district conditions, an initial planting of 3,000 seedlings was made. In the absence of glasshouse facilities, these were germinated at Meringa and forwarded in flats to Ayr, where potting took place.

The only field trial planted on the station was one to investigate ratooning performance of several district varieties under irrigated con-

ditions. This trial is designed to provide information on the economics as well as the practicability of growing first and second ratoons as opposed to plant cane only—which latter is the principal district practice.

Mackay Sugar Experiment Station.

In a varietal trial harvested, Pindar was not significantly different in performance from Q.50, and this augurs well for the newer variety. In a further experiment the seedling cane E.129 outyielded Q.28 and produced, as the aggregate of two crops, 9·31 tons of sugar per acre; in a year when red rot was particularly bad, only an odd stick of this new seedling showed discoloration. It is desirable, with the presence of ratoon stunting disease in the area, to produce a range of resistant varieties, and this cane is now under trial for susceptibility.

Following the re-introduction of C.P.29/116, a varietal trial at Oakenden demonstrated a valuable feature of this cane. In a very severe "red rot" year C.P. 29/116 outyielded Q.50, Q.28, Co.290 and B.174 and had a c.c.s. of 13·94 when the other varieties ranged from 10·77 to 6·15 due to red-rot damage. As a late harvesting cane this resistant variety would appear to have a place in the local industry.

Bundaberg Sugar Experiment Station.

The progressive seedling trials on this property have not produced any cane of outstanding promise during the year. The district is well supplied with varieties suitable for mid-season and late-season harvesting, and from early trials it would appear that Q.50 and Pindar may provide better sugar content in the early part of the season. The former cane produced 11·48 tons of sugar per acre in one series of trials as an aggregate of plant and first ratoon crops; although inferior to C.P.29/116 in yield of cane, the higher sugar content made it a more profitable cane to harvest.

The long range trials on the station dealing with trash conservation and various rotations failed to disclose any significant benefits. The first ratoons of the filter mud plus fertilizer trial did not show any clear cut responses, nor did the plant residue and fertilizer experiment which has been conducted since 1938.

SOILS INVESTIGATION.

Laboratory Work.

During the year 746 soil samples were analysed. Of these, 335 were from farmers' properties for which fertilizer recommendations were required. The remainder consisted of samples tested in conjunction with lime and fertilizer trials and the series of investigations which are being carried out in order to determine the effect of such materials as molasses and sorghum residues on the physical condition of cane soils. Fifty-two other samples, including irrigation waters, cane juices, &c., were also analysed.

Since the figures obtained from the farm samples constitute a representative picture of the soil fertility trends in the various districts, they are summarised in Table 2. As mentioned in last year's report, there are again indications that potash deficiency is more pronounced than that of phosphate. This is an important point that must be taken into consideration when planning the industry's future fertilizer requirements. The above trend is also borne out by recent fertilizer trials, the results of which indicate that adequate potash fertilization is necessary to ensure maximum sugar recovery per acre.

TABLE 2.

Soil Fertility Trend in Various Cane Areas, Showing Percentage of Soil Samples at each Fertility Level.

District.	Phosphate.			Potash.			No. Samples.
	Low.	Fair.	Good.	Low.	Fair.	Good.	
	%	%	%	%	%	%	
Babinda-Mossman	33	11	56	33	22	45	54
Innisfail ..	29	22	49	52	26	22	100
Ayr	..	..	100	..	20	80	5
Mackay ..	52	22	26	56	22	22	23
Bundaberg ..	31	14	55	51	22	27	78
Southern ..	31	20	49	33	28	39	75
Total ..	31	18	51	45	24	31	335

Fertilizer Trials.

Fertilizer trials were harvested on farmers' properties at Mossman, Fishery Falls, Moresby, Proserpine, Bundaberg and Yandina. Most of these trials showed increased yields due to the application of sulphate of ammonia, while the responses obtained from phosphate and potash depended upon the nature of the soil type.

Lime Trials.

A considerable amount of analytical work was carried out on soil samples taken from the 42 lime trials harvested last year. It would appear that the magnitude of the response to the application of lime is more closely related to the actual lime and magnesia content of the soil than to the degree of acidity present, so a series of trials is being laid down to determine the response to relatively small drill applications of lime as compared with the usual heavy and more expensive broadcast dressings.

Soil Aggregation Studies.

Because of the necessity of keeping a close watch on the possible deterioration of cane soils under continuous cultivation, laboratory studies were commenced last year to develop suitable methods for the determination of changes in the physical condition of soils. It was found that the measurement of water stable aggregates provided satisfactory data in this respect. The work was then extended to measure the effect of the application of molasses, since this material is well known to have considerable soil improving properties. In a 5 x 5 Latin square field trial set out at Moggill, preliminary results are indicating that molasses dressings bring about an appreciable increase in the percentage of water stable aggregates within the soil, thus confirming the results already obtained under laboratory conditions. A study is also being made of the effect of incorporating with the soil residues from sweet sorghums, which contain a high amount of sugar. Both field and laboratory trials are revealing that this material will also improve the crumb structure of the soil.

WEEDICIDES.

During the spring of 1949 an extensive series of trials to investigate the efficiency of 2,4-dichlorophenoxyacetic acid (2,4-D as a pre-

emergence spray under the Queensland conditions, in conjunction with contact weedicides, was put down.

Results of Pre-emergence Tests.

At Meringa, Innisfail and Bundaberg very good results were obtained from pre-emergence spraying. The results obtained on the Meringa station indicated that one application of 2,4-D applied at the rate of 4 lb. per acre early in September gave sufficient control of weeds and grasses for all practical purposes until the end of January, at which date the cane was nearly out of hand and no other treatment was necessary. The control given by the use of only 2½ lb. of 2,4-D per acre was not quite satisfactory.

At Innisfail plots were treated with 2,4-D at the rate of 4 lb. per acre. This application gave a satisfactory control of weeds and grasses from late September until February, covering a period of 21 weeks without any other treatment being required.

Other plots in this area were given a second spraying in November, consisting of a further 4 lb. of 2,4-D per acre plus diesel oil and sodium pentachlorphenate. However, from the plots which received only the initial spray in September it would appear that the second spraying was not necessary. In these trials it was also shown that 2,4-D prevented the emergence of sensitive weed and rattlepod. However, it did not prevent the germination and growth of Mauritius bean. Some results of the Innisfail sprayings are shown in Plates 7 and 8, facing page 36).

As in North Queensland, good results were obtained with the use of 2,4-D as a pre-emergence spray on the Bundaberg station. On one particular block complete control of weeds and grass during spring and summer was obtained by an application of 2½ lb. of 2,4-D per acre on September 21, followed by a similar application in December. Two other blocks were sprayed with 2,4-D at 4 lb. per acre on November 23 and December 16. These required no further treatment, since complete control of weeds and grass was obtained until the cane was out of hand in February.

Contact Spray Trials.

In addition to the pre-emergence work, a considerable amount of investigation was carried out with contact sprays based on diesel oil, tar oil or creosote and containing also sodium pentachlorphenate and 2,4–D. Further information regarding the most efficient and economical rates of application of these contact sprays has yet to be obtained and to this end trials are being laid down.

ENTOMOLOGY.

The major pests damaging sugar cane in the year under review were various species of "white grubs," which caused severe losses wherever they were allowed to persist in substantial concentrations. Army worms of two species, *Cirphis unipuncta* Haw. and *Spodoptera exempta* Walk., were represented in outbreaks throughout northern areas from Ingham to Mossman. They were present in greater numbers than had been experienced for some years, but the loss of foliage of young cane was not expected to cause serious reduction of the crop. Other cane pests continued at a normal low level and proved of little economic importance in most areas.

"White Grubs".—Large emergences of the greyback beetle (*Dermolepida albohirtum* Waterh.) commenced in most northern areas in mid-November, 1949, the population trend having continued upwards since 1947. Damage to cane was apparent in April, 1950, and it became sharply accentuated in intensity after the first week of May. A considerable proportion of the losses that would otherwise have occurred was obviated by the prior application of benzene hexachloride to many thousands of acres of cane land which had a history of consistent grub damage; but as usually happens in years of sharp population increase, heavy damage also took place in areas of intermittent or rare infestation which had not been protected in this manner. The use of BHC on 2,900 acres of cane land in Queensland in 1947 had increased in 1949 to 20,000 acres, and the heavy infestation in marginal grub-affected areas this year will have the effect of still further increasing the area that will be treated in the spring of 1950.

A 20 per cent. BHC dust (2.6 per cent. gamma isomer) is now supplied at a saving of approximately one-third of the cost of the equivalent quantity of the previously used 10 per cent. dust, and the demand by canegrowers has swung almost entirely to the 20 per cent. product for the heavier single dressings applied for protecting the plant and subsequent ratoon crops. The 10 per cent. dust is favoured chiefly for the lighter retreatments of such ratoons as did not receive adequate quantities in the plant crop to ensure sufficient residual toxicity. This change in field practice is ahead of experiments designed to compare the efficacy of the two concentrations, but progressive inspections of test plots have not as yet disclosed any unsatisfactory results from the lower volume of the higher concentration.

Field trials have shown that, provided certain precautions are taken to avoid unnecessary damage to the cane roots, BHC mixed with fertilizer and applied in the drill at planting time will control greyback grubs. Since this technique may have special value for the control of two-year-cycle grubs, and since it may also effect further economy by permitting the use of a higher concentration of BHC, this aspect is being further investigated.

The frenchi grub (*Lepidiota frenchi* Blkb.) was responsible for some losses in the areas of Mossman and Hambledon, and this pest likewise increased in severity over an area embracing the northern end of the Babinda and the southern portion of the Mulgrave cane areas. Spectacular success was achieved with control of the first instar larvae in the Babinda mill area by means of an application to the plant cane of 150 lb. of 10 per cent. BHC dust per acre. In this case a normal first ratoon crop estimated at over 20 tons per acre was produced on the treated areas, as compared with a total loss in the untreated areas. Whether or not similar results can be obtained in the drier districts remains to be determined.

In the southern areas, third stage grubs of *Pseudoholophylla furfuracea* Burm. were not

prevented from damaging cane where applications of BHC were made at rates less than 150 lb. of 10 per cent. dust per acre, and it appears that applications in excess of 200 lb. (or the equivalent) per acre will be needed if control is to be effected in this stage. The results from trials against *L. frenchi* suggest that similar successes with 150 lb. per acre may be possible against *P. furfuracea* and *Lepidiota trichosterna* Lea, provided control is effected in the first instar and the dressing is applied early enough.

Wireworms (*Lacon variabilis* Cand.).—Satisfactory protection of germinating cane setts against wireworms was obtained by the application at planting time of fertilizer containing 20 per cent. BHC at the rate of 10 lb. of the latter per acre. In Mackay and Proserpine about 9,000 acres planted in 1949 were so treated, whilst a further 5,000 acres in other parts of the Queensland cane belt were similarly protected. Damage caused by other species was also recorded from the Mulgrave area.

RAT PESTS.

Damage to cane by rats was slightly greater in the 1949 crop than in the previous year, and indications are that a still further slight increase is to be expected in the 1950 crop. Populations were not of plague proportions and noticeable damage occurred in restricted areas of favourable environment. Poison baits containing either yellow phosphorus, thallium sulphate or zinc phosphide were used as required, though there are grounds for suspecting that the strength of the zinc phosphide baits is too low.

PATHOLOGY.

Ratoon stunting disease is still prevalent in Q.28 in the Mackay district; a survey during the year showed that the disease was present on approximately 10 per cent. of the farms in the area. Several suspected cases of the disease in Q.50 were reported, but they have not as yet been confirmed. Present indications are that Q.50 will be considerably more resistant to ratoon stunting than Q.28. There is little doubt that the disease also occurs in P.O.J.2878 and M.1900 Seedling, and possibly in some of the other older varieties of the district. Ratoon stunting disease was also found at Proserpine, Sarina, Bundaberg, Maryborough and Bauple, and as a result, the variety Q.28 has been removed from the list of varieties approved for planting in the three southern districts mentioned.

After establishing that the disease could be transmitted by sett inoculation with juice from diseased cane, an extensive programme of investigational work was set out at Mackay and Brisbane. This included:—(1) A varietal resistance trial using all the important commercial canes in Queensland as well as promising seedlings from the Mackay Experiment Station and some breeding canes. (2) Hot water treatment of diseased setts. (3) Attempts at various methods of transmitting the disease. (4) Studies on the effect of disinfectants on the causative agent and its longevity outside the host plant. (5) The testing of various methods of identifying diseased plants. The results of this work should be available early next year.

Downy mildew disease occurred in only one commercial planting during the year, seven diseased stools being rogued from a two-acre ratoon field of P.O.J.2878 at Bundaberg. With the prohibition of the planting of P.O.J.2878 in the downy mildew disease area in Bundaberg, this disease should be eliminated from commercial plantings of cane in South Queensland. In the north there was no recurrence of the disease in the Hambledon area, where an outbreak had been recorded in 1949.

Fiji disease in South Queensland continues to decrease with the decreasing plantings of P.O.J.2878, and both at Bundaberg and at Moreton there has been a considerable reduction in the number of diseased stools rogued. However, seven stools of Fiji disease were found in a 9½ acre field of second ratoon P.O.J. 2878 at Cordalba in the Isis district.

Gumming disease was confined to three farms in the Mossman quarantine area, and in each case the field concerned was ploughed out after harvest in 1949.

Red rot decreased in severity in South Queensland with the reduced planting of the very susceptible variety Co.290, and losses caused by this disease there were not important during the past year. In the Mackay district, however, red rot caused severe losses in late cut fields, chiefly owing to the dryness of the spring months following an extensive early arrowing, and the prolonged crushing season. In some parts large areas of Q.50—and to a lesser degree of Q.28—were unfit for harvesting at the end of the season, and of those blocks which were cut many ratooned very poorly. Red rot also caused some losses in the drier areas of the far north.

Investigational work on different strains of the fungus responsible for red rot continued during the year, and a large number of cultures were obtained from various districts throughout the State. Many of these cultures show morphological differences and it is proposed to test their relative pathogenicity in the near future. In addition, the perfect stage of the fungus (*Physalospora tucumanensis*) has been produced in the laboratory, this being the first record of it in Australia.

Germination failures in the Burdekin area have been largely overcome by the preplanting dipping of setts in organic mercurial solutions. This area suffers severely from poor germinations largely due to the invasion of the planted setts by the pineapple disease fungus (*Ceratostomella paradoxa*). Germinations are particularly bad when a prolonged wet season delays planting until late autumn or winter and setts have to be planted in cold soil. The 1949 wet season was one such as this, and farmers were planting in the middle of May, approximately six weeks later than normal. Fortunately, however, the beneficial effect of dipping the setts in a mercurial solution prior to planting had already been proved in the area, and a number of farmers dipped the plants for all their fields. Although a total of 140 tons of plants had been treated in 1948, the 1949 season marked the first large-scale commercial application of the treatment, and results were excellent. Approximately 500 acres were initially planted with dipped setts and a further 200 acres were planted with treated setts after the first planting with undipped setts had failed. In addition,

hundreds of tons of plants were dipped for supplying misses in untreated fields which had given poor germinations.

Pineapple disease was fairly widespread throughout North Queensland during 1949 and observations showed that Trojan and Q.50 were much more susceptible to the disease than Badila. In Mackay several plantings of Q.50 failed because of the disease.

A minor element trial, set out at Mackay in a field of Q.50 ratoons which appeared to be suffering from a deficiency disease similar to that described as "droopy top" in South Queensland, has shown an excellent response to copper applied at the rate of 55 lb. of copper sulphate per acre. The plots treated with copper grew quite normally and showed an estimated increase in yield over the untreated cane of about 20 tons per acre.

During the year the Bureau took over from the Agriculture Branch an area of five acres of cultivation on University land at Moggill. This plot will be used for experimental work and for disease resistance trials which have to be moved from cane growing districts when these diseases are eliminated from commercial crops.

CANE BREEDING.

The spring and early summer conditions at Meringa during 1949 were better than had been experienced for several years and these were followed by an extended wet season. Arrowing in 1950 was much earlier than usual, and by the end of the first week in June no fewer than 134 crosses were in progress. Heavy rain when the crossing was at its height caused some trouble with dilution of solutions and also interfered with arrows on the ripening racks.

Early maturing crosses again received particular attention and large numbers of trial marriages with early maturing parents were effected. In addition, most combinations which in the past had produced progeny with a high sugar content were repeated. Entirely noble crosses were made mainly for the Burdekin district, and a high percentage of all crosses contained varying amounts of wild blood. Particular efforts were made to further nobilise the early maturing G.323, which has the *S. robustum* 28NG251 as a grandparent. G.262, the other early maturing variety with similar *S. robustum* blood, failed to arrow.

It is now necessary to produce a much greater quantity of seed and a greater diversification of crosses than formerly. Whereas a few years ago the requirements of only three stations had to be filled, it is now necessary to consider the needs of four main stations at Cairns, Ayr, Mackay, and Bundaberg, and three substations at Bartle Frere (Babinda district), Lansdowne Road (Mackay district), and Beerwah (Moreton district).

Much of the seed produced in 1949 gave a poor germination. This appears to have been largely due to a somewhat abnormal flowering season. In addition, some of the seed which did not germinate reasonably well failed to grow in the flats, and this was considered to be possibly due to a deterioration in the storage conditions at the iceworks. The failure of much of the seed does not represent a serious loss, since any deficiency in the number of seedlings produced can be made up by raising a further batch of seedlings later in the year from freshly produced seed. Among new varieties to be used in the crossing were those introduced from U.S.A. a few years ago, viz., C.P. 29/320, C.P. 34/120, C.P. 36/13 and C.P. 36/105. N.Co.310 was also used for the first time, although its extremely early arrowing was a disadvantage since it allowed of only one cross being made. These varieties have all shown early maturing characteristics and were used in attempts to produce early maturing varieties.

Among crosses which have offered promise in recent years have been various combinations of Co. 270. Although this Indian variety is very thin, it seems to impart considerable vigour to many of its progeny and in some combinations at least it gives an appreciable percentage of high sugar seedlings. The incidence of red rot has rendered necessary the replacement of several combinations with Co. 290 as major crosses for Bundaberg and Mackay. In particular, progeny of P.O.J. 2725 x Co. 290 and P.O.J. 2878 x Co. 290 appear to be very susceptible to this disease, and the examination of numbers of new families in these districts is desirable in an attempt to find other families which produce the vigour and sugar content of these two without the red rot susceptibility.

For the first time at Meringa, experimental work was carried out on the production of earlier arrowing by regulating the hours of daylight to which the growing canes are exposed. Portable light-tight boxes were used; the method showed some success, but is considered too laborious for practical use on a large scale. Arrangements have been made for the installation of a field lighting system at Meringa this year in order to use the method of breaking the period of darkness to delay arrowing in early flowering canes.

Some 21,000 seedlings were planted out in the field during 1949 at the three main stations, whilst in addition several thousand seedlings were transferred from the main stations to the substations at Bartle Frere, Lansdowne Road, and Beerwah, respectively.

A frost resistance trial was planted at Kairi Regional Experiment Station on the Atherton Tableland. Included in the trial were a number of seedlings selected as possible fodder canes. In making this selection, softness of stalk and foliage and lack of hairs were considered in addition to ratooning capabilities. There is a considerable demand in both the coastal areas and on the Tableland for better fodder canes, and it is hoped to select some desirable types for propagation in the near future.

MILL TECHNOLOGY.

Seasonal Activities.

Two phases of manufacture studied in 1948 were further investigated during the 1949 season. Tests on the operation of Webre vacuum pans were conducted at Farleigh and Plane Creek mills, and the performance of the Werkspoor crystallizer at the latter mill was also examined. These investigations formed the subjects of two papers contributed to the 1950 Conference of the Queensland Society of Sugar Cane Technologists.

Other seasonal activities of a general nature included the investigation of the influence of low purity magma on factory work and the use of soda ash as an aid in the clarification of sugar juice. Tests were carried out on the sugar dryer at Moreton mill and the boilers at Plane Creek mill, and a general survey of operations at Mulgrave mill was conducted.

The Mutual Control Scheme operated during the season, with the usual 24 mills participating. The new procedure, involving a new form of presentation and circulation on a weekly basis, proved popular.

Laboratory Work.

Testing.—During the year the following apparatus was tested:—253 brix spindles, 18 pipettes, 215 flasks, 52 polariscope tubes, 1 graduated cylinder, 1 thermometer, and 1 box of weights. Six new polariscopes were tested and certified, and six others were cleaned, overhauled and calibrated. Two new models of pH meters were examined and tested and one glass electrode was checked. Several samples of molasses were analysed for checking purposes.

Viscosimeters.—The new viscosimeter of Bureau design was checked against the standard instrument and then used in an investigation into the flow properties of molasses and massecuites. It was established that commercial glucose syrup displays the properties of a Newtonian fluid and is very suitable for use in the calibration of viscosimeters—provided that its surface is sealed with a light immiscible fluid such as kerosene.

The molasses samples tested displayed a slight degree of plasticity, whilst the massecuites exhibited this property to a marked degree. Further work on this subject is proceeding.

The opportunity arose to test a Technico viscosimeter of the torsion wire type. This instrument was found to be highly satisfactory as an industrial class of instrument for work on molasses and massecuites.

Analytical Work.—Several samples of scale from superheaters were analysed, with inconclusive results. The problem of scale formation has received considerable publicity and attention in recent years, and several methods and devices for the elimination or prevention of scale are under observation.

A sample of Australian bentonite was examined with a view to its use as a clarifying agent, but the initial laboratory tests yielded unsatisfactory results and the project was abandoned. Recently a trial shipment of Wyoming bentonite was imported and is to be used in clarification tests at Fairymead mill. The laboratory examination of this material is proceeding.

Publications.—Two technical papers have already been referred to. The Plant Data Record, which has suffered a very long delay in printing, is expected to be published in the near future, together with the First Supplement (1948). The Second Supplement (1949) and the Mutual Control Synopsis for the 1949 season are ready for printing. The publication of the News Letter has been continued.

Work in Hand.—During the coming season the task of investigating the deterioration of raw sugars in storage and transport is to be undertaken. Clarification tests will be conducted at Fairymead mill and wax extraction trials at Isis mill. It is anticipated that the staff will attend and play an active part in the Congress of the International Society of Sugar Cane Technologists to be held in Brisbane in September.

Engineering Technology.

The trend in most mills towards further electrification continues, and in the last two years no fewer than ten turbo-alternator sets of various capacities up to 2,000 kW have been ordered from British manufacturers.

Several reports covering increase in generating plant were submitted by the Bureau and in three of these the apparently drastic recommendation to change from the existing system of direct current or non-standard alternating current to the standard Queensland system was adopted by the factories concerned.

The adoption of the standard electrical system facilitates the use of Regional Board power for the slack season and crushing season week-ends, and most factories are taking advantage of this use of the public supply as being a more economical proposition than private generation.

Main switchboard designs in keeping with the generating plants to be installed were drawn up for four factories and adopted by them without alteration.

Short visits were paid to the majority of factories and several visits made on request for the purposes of special discussion.

A number of factories sought information with a view to reducing the bagasse nuisance, which, probably because of the higher boiler outputs required, tended to be more pronounced than in past years. Suitable apparatus for flue gas sampling is now being assembled and it is proposed to carry out tests during the coming crushing season. With the information obtained the Bureau should be able to make recommendations as to the most economical way of dealing with the nuisance.

PLATE 7.

Good Control of Weeds was obtained in this Sugar cane field at Innisfail by 2, 4-D spraying. The weedy row on the left was not sprayed.

PLATE 8.

2, 4-D Spraying before Seedlings emerged kept this crop clean for several months.

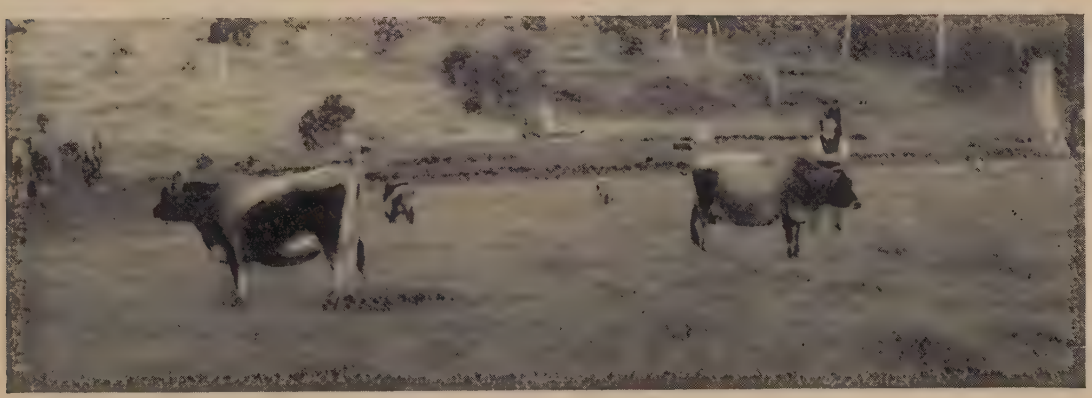

PLATE 9.

Dairy Cattle at Springbrook, showing condition after depraved appetite was remedied by Pasture Improvements.

PLATE 10.

An Improved Pasture at Springbrook, produced by the use of Dolomite and Fertilizers.

Report of the Chemical Laboratory.

Dr. M. White, Agricultural Chemist and Biochemist.

The application of chemistry to rural industry is to-day so universal that it is not surprising that each year brings its quota of fresh problems for the chemist to solve. This means that to function efficiently each section of the laboratory must keep abreast of improvements in methods and technical equipment.

The work set out under the different sectional headings indicates clearly the extensive field of chemical problems investigated by the laboratory during the past year.

TOXICOLOGY.

Three hundred and two specimens taken for examination in connection with fatalities in stock were submitted. The range of poisons found was wide and provides a useful index of the routine operations of the section.

Arsenic.

Fifty-nine specimens, or approximately 20 per cent. of the total, contained arsenic. This is a marked reduction on the figures of other years but it is still too high. Before the advent of the newer tickicides, careless disposal of arsenical dip residues and inadequate protection of the dipping vats themselves were fruitful sources of arsenical poisoning. But there were always cases following the too early use of paddocks after weed poisoning or timber destruction by arsenical compounds, and history continues to repeat itself. No such paddock is safe until either a successful burn has been obtained or sufficient rain has fallen to ensure a good growth of pasture.

Lead.

The legislation limiting the use of lead in paints made deaths of animals from this cause rare until recently, but, apparently as the result of defence disposal sales, lead-containing paints have been in use, and a sharp increase in deaths from this cause has occurred. Farm animals are strongly attracted by the linseed oil used in mixing the paint, and since lead is a cumulative poison, the lethal intake may not be obtained at one time. Of the specimens examined, eighteen were positive.

Strychnine.

As usual, nearly all the deaths from strychnine poisoning were among domestic pets.

Nitrate.

In previous reports the earlier unsuspected prevalence of nitrate in waters was recorded. The routine examination of stock waters for potability has now been extended to cover tests for both nitrates and fluorides, the first to gain some idea of prevalence and distribution, and the second as part of an extensive programme laid down some years ago. Two waters, one containing the extraordinary level of 4013 parts per million of sodium nitrate were incriminated in maladies affecting young stock.

Poison Plants.

Thirty species of plants were examined. Most followed the pattern of constituents known to be peculiar to the species, but because of its special interest one has been the subject of detailed work and is reported under Special Investigations.

Field studies by officers of other branches of the Department suggested that the plant *Eremophila latrobei* was responsible for the fatal malady of sheep and cattle known as Georgina River disease. A principle extracted from this plant during the war years was shown to be very toxic to sheep, and so a re-examination of extracts has been made. A highly active oil has again been obtained and in addition two crystalline preparations have been isolated. As soon as sufficient material from the relatively inaccessible area of common occurrence of the plant is obtained, more detailed work on the toxicity of, and counteractants to, the poisonous principle will begin.

A second investigation under way involves the search for plants which selectively remove poisons from the soil and accumulate them in special structures. Plants are being sought which can sufficiently concentrate selenium and tellurium from the soil to act as indicators.

Containers.

Pontoon drums and various containers previously used by the army are now being utilised by farmers for storage of water, molasses and grain. Some of these are chromate treated and others are lined with lead-containing material. Little is yet known of the risk from chromate poisoning, but checks have been made on the lead content of molasses stored in suspect drums. The work is not complete but the level is sufficiently high to suggest that the acids of molasses are abstracting lead from the container.

BIOCHEMISTRY.

Though a great number of routine examinations of biological material—blood, organs, bones, teeth, urine and faeces—are made for officers of other branches (some 500 samples being analysed during the year), the section maintains an active interest in the three main lines of research previously reported. Results are set out under individual headings.

Fluorosis.

The experiment initiated four years ago to evaluate the damage caused by continuous intake of fluoride through the water has been completed. It has been shown quite clearly that a level as low as five parts per million seriously affects the teeth and bones of sheep. It has further been demonstrated that none of the counteractants which have been thought to confer a marked degree of protection on caged laboratory animals fed fluorides in the diet offers any hope of prophylactic treatment for Merino sheep obtaining all their drinking water from contaminated sources. Though the levels were selected to correspond with "bad" and "very bad" waters, no evidence was found to justify the belief that the unborn lamb is affected. It is known, however, that at much higher levels a real risk exists. In case there was an abnormal accumulation of fluoride in the flesh, a number

of selected muscle samples from "poisoned" sheep were examined; the fluoride level was shown to be within the range suitable for human consumption.

The anomalies associated with the absence of fluorosis where it might have been expected, and the converse, have been investigated and satisfactorily explained. From the combined data of field and laboratory studies it now appears that the only feasible approach to the problem is through a type of management which allows alternate exposure to, and protection from, affected waters. This is a long and tedious form of enquiry, but a suitable experiment has been devised in which groups of young sheep are being subjected to various levels of fluoride intake, through the water, for different periods and with intermittent access (also for different periods) to "free" water.

A point of interest noted during the course of the first study was that fluorosis *per se* was not reflected in the wool. Only when the dental disability is sufficient to impair the gathering of food and its proper mastication does wool growth suffer. This, of course, is a much more common occurrence under field than under pen conditions.

Calculi.

Work on this serious problem, common alike to "stud" and "paddock" sheep, was foreshadowed in the last report. The magnitude of the task was not underestimated nor were the difficulties of studying a metabolic abnormality out of its climatic habitat overlooked, so that the negative evidence gleaned cannot be regarded as a failure. On the positive side it has been shown that diet is a strong predisposing factor, and that conditions favourable to the sudden production of an unusually alkaline urine in which deposits can occur are contributory.

The metabolic paths of the main inorganic constituents of the calculi analysed are now being studied. At the same time the owners of properties with a known history of fatalities due to "bladder blockage" have co-operated by sending, at bimonthly intervals, pasture specimens from suspect or incriminated paddocks. These are being examined for constituents now known to produce very alkaline urine.

Osteophagia Survey.

The programme of plotting winter and summer levels of phosphate in the soils, the pasture and the blood of cattle reared in affected zones has been continued. The areas are large and the distances too great for body fluids to be sent to a central laboratory for analysis without inviting the risk of decomposition—and consequently of false recordings. It is therefore necessary to assemble the requisite testing units and do the work on the samples freshly drawn.

GENERAL ANALYTICAL.

Use of DDT and BHC.

During the year under review there has been a further increase in the number of organic cattle dipping fluids submitted, and this has been at the expense of arsenical preparations. At present the proportion of BHC and DDT preparations to arsenical is two to one.

Vegetable Oils.

Seventy samples of oil seeds such as linseed and sunflower were examined for oil content. These analyses are part of the routine services to other branches and usually call for no special comment, but the unusual composition of some hybrid maize releases is interesting. The usual proximate analyses showed that the oil content in some cases was double that of the varieties standard for the district. This invited scrutiny for two reasons. First, the increased yields from hybrids might encourage expansion in production and hence increased use in pig feeding with all the attendant troubles of oily carcases. Second, if a very high oil level were consistently achieved, such crops might be useful for germ oil production.

Samples from the same releases were therefore obtained from different localities; again high oil content was recorded, so that a promising avenue for exploration next season has been opened.

Fodders.

The returns from cattle grazing on the residues left after the harvesting of grain sorghums have often been observed to exceed what might have been anticipated from recorded compositions of flag and stem. In view of the progress made in breeding new varieties, it was decided to evaluate a number at different periods after harvesting and to simulate in sampling, as far as possible, the grazing by stock. The main conclusions reached are:—

(1) The total digestible nutrients per unit weight equal or exceed those of good pasture;

(2) The protein level of all parts would allow a daily production level of 3 gallons of milk;

(3) So long as ample edible material is available, store cattle might be expected to reach a daily liveweight gain of 2 lb.

Miscellaneous.

Apart from the routine work associated with quality control of registered commodities, many tests have been made for contaminants, alleged deleterious constituents in tobacco, insecticide impregnation of bags, oil in fruit wrapping paper, and standards of reagents.

PLANT NUTRITION SECTION.

Field Work.

The amount of field work completed by soil chemists during the past year has greatly exceeded that of any previous year, yet demands are constantly being made for additional work—work which cannot be handled expeditiously by the present staff. Soil surveys required in connection with land settlement schemes account for much of this demand, and, where irrigation is involved, the field work is necessarily of a more detailed nature than that required for dryland farming. In connection with closer settlement schemes, assistance has been given to land survey units by attaching to them an experienced soil man to advise on the broad grouping of major soil types or soil associations. This has proved mutually beneficial, as soils information is passed to the land

surveyors and an insight into land survey methods is obtained by the soil chemists. Reconnaissance surveys or advisory field work has been undertaken in the Wandoan-Taroom, Calliope, Balcomba, Cecil Plains-Millmerran, and Theodore areas, while the field work of a detailed soil survey at Moura has been completed.

Apart from land settlement schemes, Departmental investigations have made calls on the Section. Field work has been undertaken in co-operation with members of the Agriculture and Horticulture Branches and with the Biochemical Section of the Chemical Laboratory. These are recorded below.

Wheat.

A field trial designed to test the effects of minor elements on the incidence of mottling in wheat was laid out at Wyreema. Results have not yet been collated, but it is evident from the analytical figures that so far as major plant foods are concerned there are no appreciable differences in the composition of the whole plant.

Bean Trials.

One of these was designed to test the effect of molybdenum on bean yield and quality in an area where foliar diagnosis had suggested that this element might be lacking; the other, the effect of increased potash and molybdenum applications on a soil type which from laboratory tests appeared to be potash deficient and from a study of its origin was thought might respond to molybdenum. The yields from the plots are not yet to hand, but two observations have been made:—(1) Molybdenum treatment of the seeds accelerated germination; and (2) the beans from the molybdenum treated plots had a more attractive colour and remained turgid for a longer period than those from the untreated ones. This might well prove important when considering bean transport to distant centres.

Animal Nutrition.

Three investigations involving animal health have been carried out in collaboration with the Biochemical Section. One of these was commenced several years ago, the others during the year under review, and results in all cases have demonstrated clearly the need for a very close liaison between these two sections.

In the 1947-48 annual report mention was made of an investigation being carried out on a property at Springbrook where cows of a dairy herd suffered from depraved appetites. Initial blood tests on dairy cows showed low values for both calcium and phosphate; the soil, a reddish brown clay loam derived from rhyolite, was strongly acid, very deficient in available phosphate, and probably deficient in lime and magnesia. Total nitrogen was high and potash fair

Results of the field experiment showed that responses to phosphates were obtained, but only in the presence of lime or dolomite (which contains magnesium as well as lime). The probability of magnesium deficiency was confirmed by pot tests with clover. The information obtained from the soil analysis and the field trial has since been applied to cultivated areas by the farmer and this has resulted in the growing of successful field crops which have been followed by a sowing of mixed clovers and Italian rye grass. Plates 9 and 10, facing page 36, show the excellent type of pasture now available and the healthy condition of the herd. Full details of this experiment are being prepared for publication.

The other joint investigations involving cattle concern osteophagia and "Wamps" disease. In the case of osteophagia the soil chemists are endeavouring to correlate those soil types on which bone chewing is known to occur with certain soil and plant deficiencies such as those of calcium and phosphorus. Some measure of success has been obtained, but many anomalies have yet to be accounted for. The second investigation has just begun and to date it has only been possible to carry out a very broad reconnaissance survey of portion of the area on which this disease occurs.

Forestry Problems.

Fertilizer experiments at Beerwah with seedlings of *Pinus caribaea* have demonstrated:

(1) The need for heavy applications of phosphatic fertilizer; and

(2) That their nitrogen balance is a very delicate one, as slight depressions in growth were caused by dressings of sulphate of ammonia and nitrate of soda.

Trouble was experienced at some of the forest nurseries with leaf scald in seedlings of flooded gum (*Eucalyptus saligna*) and experiments were designed to test the salt tolerance of seedlings of this plant and hoop pine. The latter was found to be moderately tolerant but the eucalypt was affected by water containing approximately 30 grains of sodium chloride per gallon.

Miscellaneous.

Two further investigational projects were the study of the effect of large quantities of irrigation water of indifferent quality on the chemical and physical properties of heavy clay soils, and a conjoint investigation with the Science Branch on papaw dieback disease. In the latter investigation 119 soil samples were examined for moisture content and 8 for moisture equivalent.

In all, 3,340 soil samples were received during the year in comparison with 2,325 for the previous twelve months. The increase was chiefly in samples submitted either by farmers or field officers for fertility measurements.

Report of the Science Branch.

Mr. J. H. Simmonds, Officer in Charge.

The Science Branch comprises the four relatively distinct sections of Plant Pathology, Entomology, Botany and Weeds. Individual reports of these sections follow. In each case the respective head of the section has been largely responsible for the subject matter of the report.

PLANT PATHOLOGY.

Cereals.

Both leaf-rust and stem-rust were more severe in the wheat crop in 1949 than in the previous season. Not only did the recognised susceptible varieties suffer, but owing to the appearance of a new strain of rust the previously resistant Yalta variety was severely affected with stem-rust.

Associated with moist conditions in October and November, an unusual outbreak of wheat scab (*Gibberella zeae*) was reported from two districts. Both were previously maize growing areas and it is noteworthy that this fungus is a common cause of cob rot in Queensland.

The prolonged wet season in the early months of 1950 resulted in an increased incidence of sorghum leaf diseases. These included rust (*Puccinia purpurea*), leaf blight (*Helminthosporium turcicum*), anthracnose (*A. colletotrichum graminicolum*) and at least three distinct bacterial diseases, one of which has been identified as bacterial streak (*Phytomonas holcicola* Bergey).

Miscellaneous Field Crops.

Potato crops in the Lockyer in the autumn of 1949 were again seriously affected with purple top wilt, which has since been identified elsewhere as a virus disease. The identification of the disease still leaves unanswered many questions regarding its epidemic development, and investigations are in hand at Gatton Irrigation Research Station and elsewhere with the object of obtaining answers to these.

Arrangements have been made to carry on and extend the potato variety resistance trials initiated by the Commonwealth Council for Scientific and Industrial Research.

The occurrence of pasmo disease in linseed for the first time in Queensland caused considerable concern. Surveys showed the disease to be widespread, but the losses occasioned were low, as it appeared late in the development of the crop. The fungus may persist from season to season on volunteer plants and in summer can attack linseed in the pre-flowering stage. Trials are in hand to study the seasonal incidence of pasmo and to determine the effect of time of planting on its occurrence.

Results from field experiments on crown rot of peanuts confirm previous work and indicate that there is no need to vary the established method of seed treatment. The effect of soil conditions on the disease was emphasised. Much better stands have been obtained both with and without seed treatments where good rotational practices have been maintained. Apparent differences due to seed treatment are much greater on old deteriorated soil than on new soil or soil which has been for a period under grass.

A survey of peanut crops on the Atherton Tableland showed that those in the wetter areas were vigorous and generally healthy. It is not anticipated that crown rot will be serious with the present rotational practice. In the drier areas crown rot was widespread, but nowhere present to an extent greater than one per cent.

In the tobacco areas of the south-west, field blue mould caused appreciable reduction in yield and leaf quality on some farms. Mosaic and "bunchy top" caused by the tomato big bud virus were general.

Deciduous Fruits.

Spray trials for the control of brown rot of stone fruits have been continued. Beneficial results were obtained when the disease was moderately prevalent. However, extremely wet weather such as occurred in February favoured the fungus to such an extent that there were no differences between sprayed and unsprayed plots in the trial carried out at that time.

The collar rot of apple trees due to *Sclerotium rolfsii,* recorded in the previous season, continued to give considerable concern. There is some evidence that cutting away the affected parts and painting with Bordeaux mixture promotes recovery if performed sufficiently early.

Citrus.

In a trial of chemical dips for the control of blue mould of citrus fruit, salicylanilide, tetramethyl-thiuramdisulphide and borax treatments significantly reduced the disease. Salicylanilide at 1 per cent. strength was the best treatment; it reduced mould from the 25 per cent. encountered in untreated fruit to 2.4 per cent. The borax dip resulted in some scalding, while 2 per cent. T.M.T.D. left an undesirable residue.

The experiment commenced in 1948 in conjunction with the Horticulture Branch, and involving spray, pruning and soil treatments for the control of brown spot of the Emperor mandarin, was repeated last season with slight modifications. Some of the treatments showed significant differences but no worthwhile control was obtained in what was a particularly bad outbreak.

Tropical Fruits.

In experiments for the control of base rot of pineapple planting material conducted at Maroochy Horticultural Experiment Station, a strong Bordeaux mixture dip gave almost complete control of the disease. Treatments with a mercury or an organic fungicide dip and

spraying with a copper spray after planting had no effect. Planting on hills appeared to reduce the disease to some extent. Unfortunately there was a distinct stunting of plants following the copper dip, measurements indicating a reduction of 14 per cent. in length of leaf. Further trials involving modification of the treatment to overcome this adverse effect are in hand.

Losses from yellow crinkle of papaw have been lighter than usual. Similarly, in the case of dieback there was no epidemic development except one occurring in early spring. Powdery mildew was responsible for considerable scarring in late maturing fruit, and the need for more attention to dusting for this disease was indicated.

The papaw fruit rot observations carried out last season at Maroochy Horticultural Experiment Station showed evidence of considerable variation in rot resistance among the varieties evolved at the station. Some of the more promising of these are being planted at Redlands Horticultural Experiment Station, where their potentialities will be further explored. Fruit spotting may be caused by any one of at least four distinct fungi—*Gloeosporium spp, Ascochyta caricae, Phomopsis* sp. and *Rhizopus nigricans.* Investigations into the seasonal occurrence, source of infection, &c., of these organisms are proceeding.

Investigations of the custard apple fruit rots known as black canker or purple fruit blotch have demonstrated the association of three organisms—*Diplodia natalensis, Phytophthora* sp. and *Phoma* sp. The relative importance of these fungi and their seasonal distribution are matters of current enquiry.

Vegetables.

Prolonged wet periods during the year resulted in severe disease outbreaks in vegetables. The bacterial spots of tomato have been serious and some crops grown for seed certification had to be rejected. Phoma fruit spot of tomatoes was also prevalent. On beans, angular leaf spot (*Isariopis griseola*) was again much more severe than was expected from its behaviour prior to the last few seasons. A high incidence of virus diseases such as spotted wilt and big bud has also been noted on numerous hosts.

During the year special attention has been paid to diseases appearing in the markets. It was found that much of the loss was associated with packing damaged produce on which there subsequently developed *Rhizopus* and other rots.

Beans arriving in the Brisbane market from Stanthorpe during February and March were affected with cottony leak (*Pythium aphanidermatum*). This disease spreads rapidly through packed beans during warm weather.

General.

Assistance has been given by way of pathological inspections in connection with the various seed certification schemes, more especially in the case of tomatoes and beans. A strawberry approved runner scheme was carried through in co-operation with the Horticulture Branch. Assistance was also given in selecting Lady Finger banana plantations free from Panama disease to form a suitable source of suckers of this variety.

The number of cultures supplied for legume inoculation during the year was substantially higher than in previous years.

An examination of material held has shown that the identification of an onion infection, recorded in the 1938-39 annual report as onion smut (*Urocystis cepulae*) was incorrect. Onion smut is still unknown in Queensland.

ENTOMOLOGY SECTION.

Fruit Flies.

Attacks on commercial fruits by these pests, chiefly *Strumeta tryoni* Frogg., were reported from widely scattered districts throughout the State. These included the first records from some localities for many years. Extended summer rains interfered with protective spraying, and early ripening of fruit was an added factor responsible for abnormal losses.

In August, a conference of Commonwealth and State representatives was held in Melbourne to discuss the incidence of fruit flies in Australia and its effect on the export trade in fresh fruit. Subsequently cold storage investigations at Stanthorpe were discontinued, but preparations have been made for intensified field and laboratory studies of these pests. An insectary has been built at Toowoomba, and routine trapping and host surveys have been extended.

Pests of Deciduous Fruits.

Spray trials carried out in the Stanthorpe district involved calyx spray applications and cover spray schedules against moths and mites. Results confirm the previous observation that a calyx spray is unnecessary when suitable DDT cover spray schedules are used. E.605 can be disregarded as an alternative to DDT against codling moth (*Cydia pomonella* L.). However, this new insecticide is of very definite value in the control of woolly aphis (*Eriosoma lanigerum* Hausm.) and the mites *Tetranychus urticae* Koch and *Bryobia praetiosa* Koch.

Citrus Pests.

In some of the coastal districts red scale (*Aonidiella aurantii* Mask.) has been more prevalent than usual, and circular black scale (*Chrysomphalus ficus* Ashm.) appears to be increasing. In all districts where strict attention has been paid to spraying schedules, commercial control of scale pests has been attained, but increasing spraying costs are causing much concern. The poor results in screening tests with E.605 against red scale, pink wax (*Ceroplastes rubens* Mask.) and white wax (*Ceroplastes destructor* Hewst.) did not warrant larger field trials.

The citrus gall wasp (*Eurytoma fellis* Gir.) continues to be a problem, particularly with grapefruit and lemons. Galling was as wide-

spread and as severe as in the previous season, and pruning to remove galls is far from satisfactory as a control measure. Experimental work has been continued covering basic sampling methods, protective foliage sprays, flight habits of the pest, and the possible value of E.605 as a systemic poison against the larvae.

Potato Pests.

The tuber moth (*Gnorimoschema operculella* Zell.) was again responsible for losses in the field when cultural and spraying programmes were not carried out. Almost universal tuber dusting with DDT continues to keep post-harvesting and storage losses at a reasonably low level. In a few instances, where dusts containing BHC as well as DDT were used for tuber protection, tainting resulted.

Large scale storage experiments were established during the summer at the Queensland Agricultural High School and College. The results strongly indicate that, at the strength used, DDT impregnated bags give protection against the moth at least equal to dusts applied directly to the tubers, and at the same time overcome residue troubles. Follow-up work on this project is directed towards the formulation of commercial procedures.

Tobacco Pests.

In the Burdekin district crops were attacked by several pests during the main growing period, and frequent sprayings were necessary to keep damage at a low level. The looper (*Plusia argentifera* Gn.) is still difficult to control with present schedules. The root knot nematode (*Heterodera marioni* (Cornu) Goodey) is present in much of the new land coming under tobacco, and, to date, pest populations have not been reduced by including resistant crops and a four-months dry bare fallow in the rotation.

In the Inglewood, Yelarbon and Texas districts DDT has been used extensively to control lepidopterous and jassid pests. A potentially serious Eriophyid mite has appeared in these districts and some growers suffered severe losses with mid-season and late crops.

Grain Pests.

Weevil damage to maize and sorghum, particularly the former, has been given considerable attention during the past six months. It has been again demonstrated that either DDT or BHC dusts will protect initially clean maize seed, at least for several months, without affecting germination. Infestation prior to dusting is a complicating factor in this problem, and the economic treatment of grain for food constitutes a formidable task under Queensland farm conditions.

Tropical Fruit Pests.

Natural causes and cultivation have kept populations of the pineapple scale (*Diaspis bromeliae* Kern.) at a low level in the quarantine area, and results from insecticidal trials are neither conclusive nor commercially promising. D.D. experiments against nematodes in pineapple fields on the Blackall Range have not as yet given outstanding results.

Exploratory experiments with insecticides against the banana weevil borer (*Cosmopolites sordidus* Chev.), as reported last year, were continued using only chlordane and E.605. With beetle counts at baits as a criterion, 1 per cent. chlordane spray applied with the trash undisturbed appears worthy of further investigation, although under present conditions the treatment may be uneconomic.

The harvest results of large scale trials with sprays against red scale (*Aonidium aurantii*) on figs in the Sunnybank area have clearly demonstrated that an economically sound schedule is available. Further work in the coming season will be directed towards clearing up some minor points to complete the project satisfactorily.

Vegetable Pests.

Numerous screening tests of the newer insecticides were carried out during the year. As might be expected, some of the earlier claims made for these materials could not be substantiated. E.605 is proving a satisfactory alternative to nicotine sulphate, but DDT is still the best material for many purposes. BHC burns several crops and may cause off-flavours.

In general, mites, thrips and aphids have caused some concern to growers. Replicated trials using a wide range of materials and strengths were set out against *Thrips tabaci* Lind., *Tetranychus urticae* Koch., *Aphis gossypii* and *Macrosiphon solanifolia* Patch. on cucumbers. Thorough spraying with E.605 at recommended label strengths gave good, quick kills, but insecticidal persistence was not outstanding.

Miscellaneous Field Crops.

Corn ear worm and *Earias huegeli* Roz. were present in some fields of cotton without showing any high peaks of activity. Experiments against cotton insects were somewhat marred by these low pest populations, but it is evident that DDT is not entirely satisfactory in this crop. The looper (*Anomis flava* Fabr.) extensively defoliated experimental cotton in the Warwick district.

Many sorghum crops were infested with *Aphis maidis* Linn. but no economic damage was apparent. The sorghum midge (*Contarinia sorghicola* Coq.) was present in some Darling Downs crops during February and March, and it caused severe losses in the South Burnett. The yellow peach moth (*Dichocrocis punctiferalis* Gn.) attacked heads in some of the northern areas. Insect pests were of no importance in Central Queensland fields.

Considerable efforts were made by firms interested in the crop to spray large areas of linseed, although Heliothis populations were insignificant in most early plantings. Crops planted in June and July were infested by appreciable pest numbers by late September.

In the Lockyer Valley severe damage to lucerne by the jassid *Empoasca alfalfae* Evans was not so evident in the summer and autumn as in the previous year, when eventually 0.1 per cent. DDT sprays were applied extensively after each cutting.

Apiaries.

In south-eastern Queensland, 969 beekeepers are now registered, an increase of 130 since the last report. The number of growers is expanding steadily and some essential hive equipment is now manufactured locally. However, production in Queensland is still not sufficient to meet the State demand.

There has been an increasing demand for information and advice on all phases of beekeeping. The provision in *The Apiaries Act of* 1947 for special protection of queen-rearing apiaries has been well received and is now working satisfactorily. This is believed to be a pioneering attempt to protect the purity of breeding strains by preventing encroachment by other apiaries.

The two apiaries previously reported to be infected with American foulbrood (*Bacillus larvae* White) are now disease free. European foulbrood (*Bacillus alvei* Cheyne) was found in one hive in the Warwick district. This is the first record for Queensland. Paralysis and dysentery have also been observed in several apiaries, and wax moths (*Galleriia mellonella* L. and *Achroia grisella* Fabr.) caused heavy damage in some stored beecombs. Methods of preventing damage by these insects are available, but action is often delayed until serious infestations are observed.

Fauna Protection.

Experience in administering fauna legislation had suggested further possible improvements and consideration has been given to these during the year. Sanctuaries, well distributed throughout the State and covering 124,894 acres, have been gazetted. A district register of 1,300 honorary protectors, including 55 appointed during 1949-50, has been completed and is proving of value for administrative and extension purposes.

Flora Protection.

Protection has been extended to various native plants, comprising boronia (*Boronia* spp.), Christmas bells (*Blandfordia* spp.) and vanilla Lily (*Sowerbaea juncea* Sm.) Five new honorary rangers have been appointed.

Enquiries into several reports of contravention of *The Native Plants Protection Act of* 1930 have had the desired salutary effect, as evidenced by the cessation of several questionable practices.

BOTANY SECTION.

Noxious Weeds.

The Noxious Plants Consultant Sub-Committee of the Stock Routes and Rural Lands Co-ordinating Board recently decided that there was a necessity for revising the list of plants declared as noxious weeds throughout the State under various Acts, especially the *Local Government Acts,* which contain by far the greatest number. In many cases lists have been drawn up by individual local authorities without reference to the actual distribution of the weeds listed and regardless of whether the plants were likely to occur within the shire boundaries or not. Following this decision lists of declared noxious plants supplied by the Director of Local Government and others have been thoroughly checked, and after consultation with officers of the Lands Department the revision will be submitted through the Sub-committee to the various Departments concerned.

Of weeds that have made their appearance for the first time or have spread considerably during the past year, the following should be recorded:—Burr ragweed (*Franseria* sp.); Crofton weed (*Eupatorium adenophorum*); hemlock (*Conium maculatum*); and ragweeds (*Ambrosia* spp.). Other plants the spread of which should be closely watched are *Synedrella viaiiis* (no recognised common name) and golden rod (*Solidago canadensis*).

Mulga Research.

In continuation of research on mulga (*Acacia aneura*), 150 lb. (air-dried weight) of leaves and small twigs of umbrella mulga and a similar quantity of whipstick mulga were collected and submitted to the Agricultural Chemist for digestibility trials with sheep.

From information gathered during the year, it appears that mulga regeneration is dependent on the non-stocking of paddocks by sheep until seedlings are well established. Cattle and horses do not do the same damage to the seedlings. A paper embodying the results of investigations on mulga to date was published during the year.

Vegetation of "Scalded" Areas.

In connection with studies on the vegetation of "scalded" areas in the Dirranbandi district, 15 quadrats were laid down in November, 1949. These were examined in February and again in May. It was found that the two months of dry, very hot weather which followed the first observation resulted in a decrease in numbers of the two *Chloris* grasses (*C. divaricata* and *C. truncata*) and a regression of the islands towards the scalded condition where *Tripogon* is almost the only perennial grass species. The weather during the following eleven weeks was particularly favourable to plant growth. There was a remarkable recovery in the *Chloris* grasses, and seedlings of annual herbage plants became plentiful. An encouraging feature was the presence in greatly increased numbers of *Medicago minima.* This is the only leguminous species yet recorded from the scalded areas and its presence indicates that it might succeed on these areas if seeds were sown in furrows made in the course of reclamation work.

Western Legumes.

In connection with trials of native legumes from western Queensland, seeds of 16 species were collected for further work on regional experiment stations. Most of the samples were small and sufficient for only one sowing. However, a quantity of seed was collected of the Cooper clover (*Trigonella suavissima*), a plant that has considerable possibilities as an annual fodder crop under irrigation and as a green manure.

Botany of the Burdekin Valley.

At the request of C.S.I.R.O., a botanist accompanied a soil survey unit to the western side of the lower Burdekin valley to identify plants in the field and to assist in mapping plant associations in relation to soils. The plant communities or groups of communities of the area can be divided into nine major types. A fairly detailed account of each community was compiled and this and a complete list of plants observed were supplied to the survey party.

Poisonous Plants.

The most spectacular piece of work on poisonous plants during the year was on the cause of Birdsville horse disease. Following two visits to the Windorah-Betoota area in June and August, 1949, it was evident that if a plant was the cause of the trouble, the strongest circumstantial evidence was against *Indigofera enneaphylla*. Later, in January, at the request of the Division of Animal Industry of the Northern Territory Administration, a visit was made by one of the botanical staff to the Alice Springs district for the purpose of examining areas where cases of Birdsville horse disease had occurred and to compare the vegetation with that of areas in south-western Queensland where the disease was also known. *Indigofera enneaphylla* was found to be abundant in all areas where the disease occurred in Central Australia. Feeding tests conducted by officers of the Northern Territory Animal Industry Division produced symptoms typical of the trouble. This disease has been prevalent in the areas concerned for many years, and the progress made in its elucidation is very gratifying.

Systematic Botany.

In the field of systematic botany a monograph has been prepared on the genus *Argyrodendron*, a genus of trees the timber of which is known in the trade as tulip oak; two genera, *Pterocarpus* and *Mastixiodendron*, have been completed for the joint publication with the C.S.I.R.O. and the New Guinea Forest Service, dealing with New Guinea timber trees; a preliminary revision of the genus *Diploglottis*, which contains the "native tamarinds," has been made; and descriptions of several new rain-forest trees from North Queensland have been drawn up.

Many specimens of grasses and sedges were named for southern herbaria and correspondents, as well as a large number from Queensland. A study of Northern Territory eucalypts has been continued in connection with the work of the North Australia Regional Survey. This work throws a good deal of light on the nomenclature of some North Queensland species. A start has been made on a study of the plants collected in the Cape York Peninsula in 1948 by the Archbold Expedition and provisional revision of several groups undertaken.

WEEDS SECTION.

Surveys.

Preliminary surveys of the distribution of foxtail grass (*Pennisetum villosum*) on the Darling Downs, hemlock (*Conium maculatum*) at Peachester and *Franseria* sp in the Cloyna district have been made. A detailed survey of the distribution of Crofton weed (*Eupatorium adenophorum*) in Queensland has been made and a comprehensive report prepared.

Experimental.

Several experiments on the chemical control of regrowth of Crofton weed were carried out at Numinbah. The combination of 2,4-D and 2,4,5-T esters gave a 75 per cent. kill when heavily applied in a 0.4 per cent emulsion. Sodium chlorate gave a complete kill when heavily applied in a 5 per cent. solution. Ammonium sulphamate was ineffective when applied heavily in a 10 per cent. solution. The sodium salt and ethyl ester of 2,4-D and sodium salt of M.C.P.A. were ineffective even if heavily applied in a 0.4 per cent. solution or if applied twice in a 0.2 per cent. solution. The butyl ester of 2,4,5-T was ineffective when applied twice in a 0.2 per cent. emulsion but gave a complete kill when heavily applied in a 0.4 per cent. emulsion.

Experiments on the control of timber regrowth with hormones have been commenced. At Wolvi, near Gympie, tests were conducted on bloodwood, spotted gum, ironbark, blue gum, forest oak and various wattles. Results from these indicate that 2,4,5-T is markedly superior to 2,4-D and that solutions (either aqueous solutions of salts or kerosene solutions of esters) are more effective than emulsions. At Beechmont tests were conducted on wild tobacco; at Tiaro on mahogany; at Nerang on *Leptospermum flavescens;* and at Biloela on brigalow and *Acacia salicina*. Results from Beechmont indicate that the best method of controlling wild tobacco is to brush and swab the butts with the power kerosene alone. No results from the other trials can be considered conclusive.

At Moggill, 2,4-D and 2,4,5-T esters combined were tested on *Verbena rigida, Verbena tenera,* wild verbena (*Heliotropium amplexicaule*), *Solanum nigrum, Sida rhombifolia* and *Malvastrum coromandelinum*. The first two and *Salonum nigrum* were completely killed by a 0.2 per cent. emulsion. Young plants of *Sida* and *Malvastrum* were killed; older plants were defoliated but showed some regrowth. Wild verbena was not damaged by a 0.2 per cent. emulsion, but a 0.4 per cent. emulsion killed all plants which were completely covered with spray. Regrowth occurred on any plants the leaves and stems of which were only partially covered.

At Kerry the effect of 2,4-D on hybrid maize is being studied. The use of 2,4-D with DDT was investigated and it was found that a solution of 2,4-D could be used quite satisfactorily with a DDT emulsion. It was also found that *Ambrosia tenuifolia* could be killed at all stages by high volume spraying with 0.1 per cent. sodium 2,4-D, and that bellvine (*Ipomoea plebeia*) could be killed by applying 0.1 per cent. sodium 2,4-D at 20 gallons per acre.

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